TM 11-5097

(TO 33A1-5-64-1)

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

SPECTRUM ANALYZER TS-723A/U

DEPARTMENT OF THE ARMY • JANUARY 1957

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 430-volt plate and power supply circuits, or on the 115- or 230-volt ac line connections.

DON'T TAKE CHANCES!

TECHNICAL MANUAL No. 11-5097

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *24 January 1957*

SPECTRUM ANALYZER TS-723A/U

Figure 1. Spectrum Analyzer TS–723A/U.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains instructions for the installation, operation, maintenance, and repair of Spectrum Analyzer TS–723A/U (fig. 1).

b. Forward comments on this manual directly to the Commanding Officer, The Signal Corps Publications Agency, Fort Monmouth, N. J.

2. Forms and Records

a. Unsatisfactory Equipment Reports. Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) to Commanding Officer, Signal Equipment Support Agency, Fort Monmouth, N. J., as prescribed in AR 700–38.

b. Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700–58 (Army); Navy Shipping Guide, Article 1850–4 (Navy); and AFR 71–4 (Air Force).

c. Preventive Maintenance Forms.

(1) DA Form 11–238 (Operator First Echelon Maintenance Check List for Signal Corps Equipment—Radio Communication, Direction Finding, Carrier, Radar) (fig. 6) will be prepared in accordance with instructions on the back of the form.

(2) DA Form 11–239 (Second and Third Echelon Maintenance Check List for Signal Corps Equipment—Radio Communication, Direction Finding, Carrier, Radar) (fig. 7) will be prepared in accordance with instructions on the back of the form.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. The spectrum analyzer is used to measure harmonic distortion and noise level in audio frequency (AF) amplifiers. Measurements of distortion are made in percentage or in decibels (db), and measurements of noise are made in effective or root means square (rms) values or in db values referred to 1 milliwatt (mw) across 600 ohms (dbm). The spectrum analyzer can also be used as an alternating current (ac) vacuum tube voltmeter (vtvm) to measure ac signals as low as 0.0003 volt.

b. The measured signals can be interpreted more accurately when an oscilloscope (not furnished) is used with the spectrum analyzer.

4. Technical Characteristics

Distortion measurement range	Fundamental frequency from 20 cps to 20 kc.
Frequency calibration accuracy	±2 percent from 20 cps to 20 kc.
Filter characteristics	Fundamental frequency is rejected by more than 99.99 percent, or down approximately 80 db.
Second harmonic attenuation	Less than 17 percent (−1.5 db) in the fundamental range from 20 to 5,000 cps. Less than 32 percent (−3 db) in the fundamental range from 5 kc to 20 kc.
Residual harmonic measurements	Residual frequencies (harmonics of the fundamental frequency) are measured to within ±3 percent of the full scale value for distortion levels as low as 0.5 percent. Meter indications are proportional to the average value of the residual components. Distortion introduced by the instrument is less than 0.1 percent.
Sensitivity	Distortion levels as low as 0.3 percent may be measured full scale. Levels of 0.1 percent are accurately readable.
Noise amplifier gain	40 db gain ±1 db from 20 cps to 15 kc.
Set-level amplifier gain	20 db gain ±1 db from 20 cps to 20 kc. ±2.5 db from 10 cps to 100 kc.
Amplifier input impedance	Approximately 200,000 ohms, 40 μμf shunt.
Input level for distortion measurement.	Rms 1 volt, minimum.
Meter ranges	Full scale 0.03, 0.1, 0.3, 10, 30, 100, 300, R. M. S. VOLTS. Db: −30, −20, −10, 0, +20, +30, +40, and +50.
Vtvm section frequency range	10 cps to 100 kc.
Vtvm section frequency response	Flat ±3 percent of 1,000 cps from 10 cps to 100 kc on all ranges.
Meter calibration	Calibrated to read rms of a sine wave with two linear voltage scales· 0 to 1 volt and 0 to 3 volts. Voltage ranges are related by 10-db steps. Zero dbm—1 mw across 600 ohms 1,000 cps. Dbm scale calibrated from −12 dbm to +2 dbm.
Full scale meter movement	1 ma.
Voltmeter input impedance	Input shunt capacitance approximately 37 μμf. Input shunt resistance: 0.03- to 30-volt range is 1 megohm; 100-volt range is 3 megohms; 300-volt range is 2.4 megohms.
Meter overload capacity	Will not be damaged by overloads of up to 100 times normal load.
Noise measurement	Full-scale readings can be made of 300 microvolts. Noise measurement range is 10 cps to 20 kc. Satisfactory readings can be made down to −75 dbm.
Input power supply rating	Voltage—115 volts (may be modified for 230-volt operation). Frequency—50 to 1,000 cps. Wattage—90 watts.

5. Description of Spectrum Analyzer

The spectrum analyzer consists of a panel-chassis assembly (fig. 1) with a bottom cover and a perforated metal cover that covers the top and rear of the chassis. The equipment can be mounted in a standard 19-inch wide equipment rack. All operating controls and connecting binding posts for standard operation are on the front panel. The power fuses, two binding posts, and the HUM BAL control are on the rear panel (fig. 4). The power cord is permanently attached to the chassis and extends through a hole in the rear panel.

6. Running Spares

The following is a list of the running spares:

1 tube, 6J5.
1 tube, 5Y3GT.
1 tube, 6Y6G.
1 tube, OD3.
1 tube, 6H6.
2 tubes, 6SJ7.
2 tubes, 6AC7.
6 fuses, 1.6-amps.
6 fuses, 0.15-amps.
1 panel lamp, 6.3-volt, 0.5-amp.

Note. This list is for general information only. See appropriate supply publications for information pertaining to allowable spare parts.

7. Additional Equipment Required

a. A shielded test cable with banana plug connectors is the only component required to operate the spectrum analyzer as a test unit.

b. An oscilloscope or a linear radio frequency (RF) detector (par. 41*a*), when used with the spectrum analyzer, will extend the usefullness of the equipment.

c. When relay rack mounting is desired, a standard 19-inch wide equipment rack is required.

CHAPTER 2

INSTALLATION

Section I. SERVICING SPECTRUM ANALYZER

8. Siting

The spectrum analyzer may be mounted in a standard 19-inch equipment rack or be placed on a test bench.

9. Packaging Data

The spectrum analyzer and its running spares are packed as shown in figure 2. The crate is 21¼ inches deep, 32¼ inches wide, and 24⅞ inches long. The volume of the crate is 9.87 cubic feet and it weighs 100 pounds.

10. Uncrating and Unpacking (fig. 2)

Uncrate and unpack the spectrum analyzer as follows:

a. Place the wooden crate as near the operating position as convenient.

b. Cut and fold back the metal straps.

c. Remove the nails with a nail puller. Remove the top of the packing case. Do not attempt to pry off the sides and top; the equipment may be damaged.

d. Remove the outer carton and carefully cut and remove the waterproof barrier.

e. Open the outer corrugated carton and remove the inner corrugated carton.

f. Carefully cut and remove the moisture-vapor-proof barrier.

g. Open the inner corrugated carton and lift out the small carton containing the running spares.

h. Remove the corrugated cardboard blocking and felt pad and lift the spectrum analyzer out of the corrugated carton.

11. Checking

a. Check the contents of the package against the master packing slip to be sure that all components are present.

b. Inspect the equipment for possible damage (incurred during shipment), such as cracked glass on the meter or tuning dial.

c. Rotate the controls and check the switches for smoothness of operation. Binding or jamming indicates abnormal mechanical operation. Do not force the controls because this may cause permanent damage.

d. Remove the fuses, located on the rear of the equipment, and check to see that they are of the proper ratings as marked on the rear panel.

Caution: The ac line fuse (fig. 4) is rated at 1.6 amperes at 115 volts for 115-volt operation and is rated at 0.8 ampere at 230 volts for 230-volt operation.

e. The tubes are already installed when the equipment is shipped. Refer to paragraph 37 for tube replacement techniques.

12. Service upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions given in paragraphs 10 and 11 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes in wiring have been made, note the change in this manual, preferably on the schematic and wiring diagrams. If the wiring changes show that the spectrum analyzer is set for 230-volt operation, and the available power source is 115-volts, refer to paragraph 13*a* for instructions on how to change the equipment back to 115-volt operation.

c. Check the operating controls for ease of rotation. If lubrication is required, refer to the lubrication instructions given in paragraph 34.

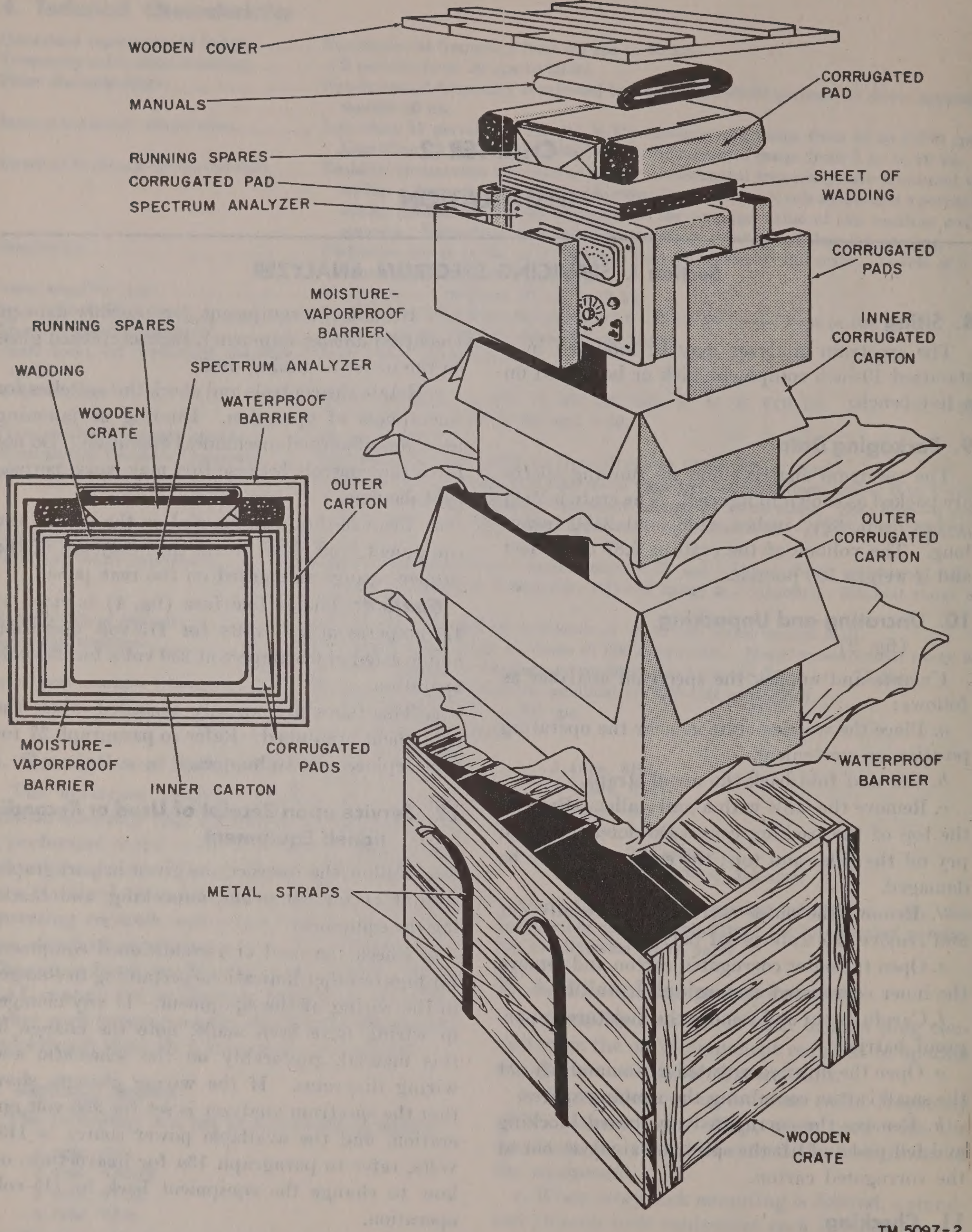


Figure 2. Packing and packaging of spectrum analyzer.

13. Strapping Power Transformer T1

Power transformer T1 is normally strapped in the 115-volt position. If the source voltage is 230 volts, follow the procedure given in *a* below. If the source voltage is 115 volts and T1 is strapped for 230 volts, follow the procedure given in *b* below.

a. Strapping T1 for 230-Volt Operation.

(1) Remove the bottom cover.

(2) Refer to block 10 on figure 29 and disconnect the jumpers connected between terminals 3 and 4 and 5 and 7 on terminal board TB7 (fig. 20).

(3) Connect a piece of No. 18 AWG bare copper wire between terminals 4 and 5 on TB7.

(4) Replace the cover.

(5) Be sure the fuse is rated at 0.8 amp at 230 volts and place a tag on the spectrum analyzer indicating the equipment is set for 230-volt operation.

b. Strapping T1 for 115-Volt Operation.

(1) Follow (1) and (2) in *a* above except to disconnect the jumper connected between terminals 4 and 5.

(2) Connect a piece of No. 18 insulated copper wire between terminals 3 and 4 and another piece between terminals 5 and 7 on TB7.

(3) Follow (4) and (5) of *a* above except to check that the fuse to be used is rated at 1.6 amps at 115 volts and the tag indicates 115-volt operation.

14. Connections

a. Make the power and ground connections to the spectrum analyzer as follows:

(1) Connect the power cord to an ac power source of 115 or 230 volts. If the ac wiring has to be changed, refer to paragraph 13 for instructions.

(2) The power cord plug has a round grounding terminal. If the ac power outlet will not accommodate this plug, replace the power cord plug with connector plug type UP–121M or any other three-terminal plug that will accommodate the receptacle.

(3) If the ac convenience outlet is of the standard two-slot type, replace the plug on the power cord with a standard type ac plug. Ground the spectrum analyzer with a heavy wire such as a piece of No. 12 AWG copper wire.

b. Make the input and output signal connections as follows:

(1) For distortion measurements, connect the test leads to the AF INPUT binding posts.

(2) For noise, signal level, or gain measurements requiring preamplification, connect the test leads to the AF INPUT binding posts.

(3) For noise, signal level, and gain measurements that do not require preamplification, connect the test leads to the METER binding posts.

(4) If an oscilloscope is to be used, connect the oscilloscope to the OSCILLOSCOPE binding posts.

CHAPTER 3
OPERATION

Section I. CONTROLS AND INSTRUMENTS

15. General

Haphazard operation or improper setting of the controls can cause damage to the meter in the spectrum analyzer. For this reason and to operate the equipment more efficiently, it is important to know the function of every control and meter on the equipment. The actual operating instructions are contained in paragraphs 17 through 25.

16. Controls and Instruments
(figs. 3 and 4)

The following chart lists the controls and instruments of the spectrum analyzer and indicates their functions:

Control or instrument	Function
ON-OFF power switch	Turns on the equipment.
Signal INPUT control	Controls the input level of the applied signal in any position of the function switch except the METER position.
AF-RF selector switch	Selects input signal from either the AF INPUT or the AF-RF INPUT (fig. 4) binding posts.
Frequency RANGE switch	Selects any of the three frequency bands available. The frequency range band is given below: X1 — 20 cps to 200 cps X10 — 200 cps to 2,000 cps X100 — 2,000 cps to 20 kc
FREQUENCY tuning dial	Indicates reading of input signal frequency in conjunction with the frequency RANGE switch. Direct dial readings are given from 20 to 200.
FREQUENCY tuning controls	Tunes spectrum analyzer to input signal frequency within the limits set by the frequency RANGE switch.
Coarse FREQUENCY control (upper knob)	Used for coarse tuning adjustments.
Fine FREQUENCY control (lower knob)	Used for fine tuning adjustments.
Function switch	Selects desired function as follows: *Positon* — *Function* DISTORTION — Adjusts equipment to measure harmonics of input signal compared to a reference level. SET LEVEL — Adjusts input signal to a reference level for distortion measurements and increases the range level when measuring noise signals. NOISE — Used for voltage measurements of very weak signal inputs. METER — Used to measure ac signal voltage when input signal is connected to the METER binding post.
BALANCE control	Adjusts equipment in conjunction with DISTORTION position of function switch.
HUM BAL control	Adjusts equipment to prevent internal interference.
Meter range switch	Selects proper range scale in db, dbm, percentage, or rms values for the meter. Each setting of the switch represents a full-scale deflection of the meter equivalent to the designation of the position.
Meter indicator	Shows measurements by needle deflection on designated scale when used with the meter range switch.

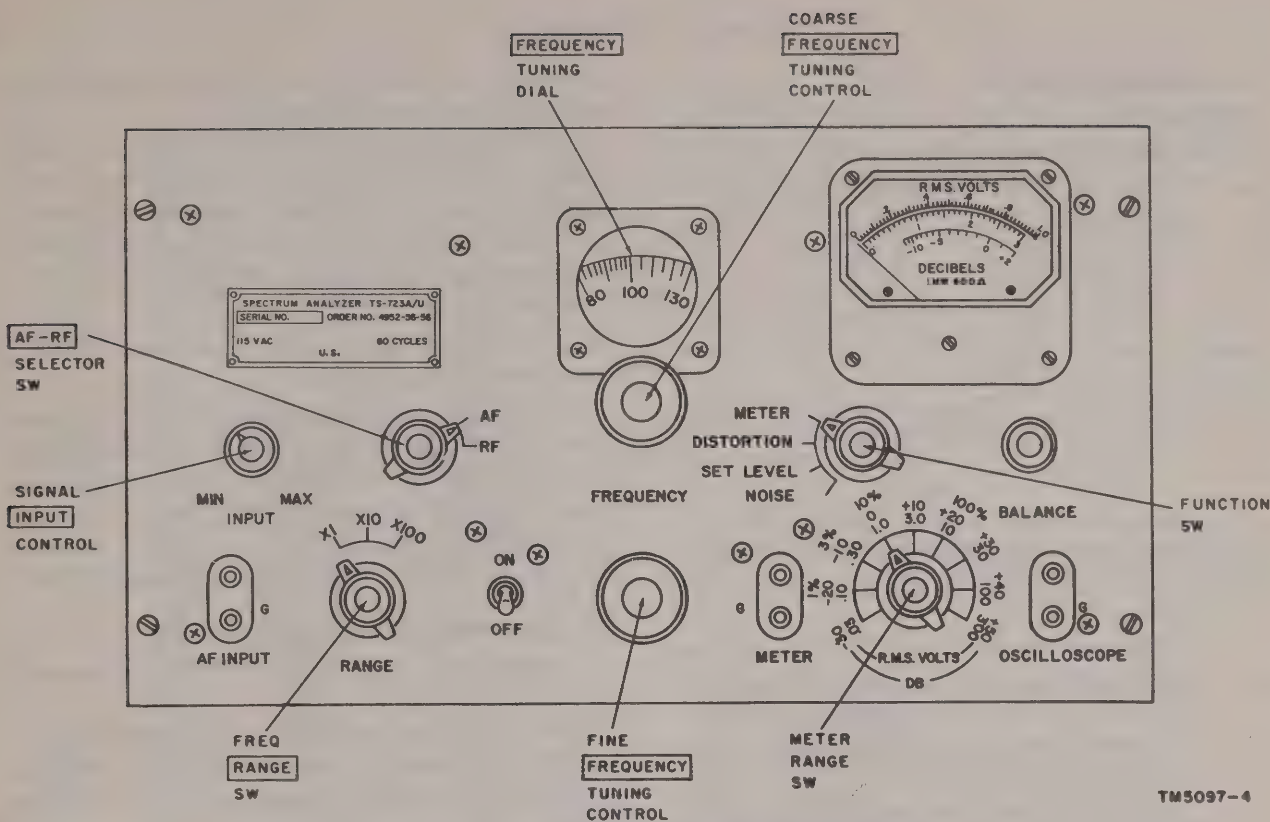


Figure 3. Front panel controls and instruments.

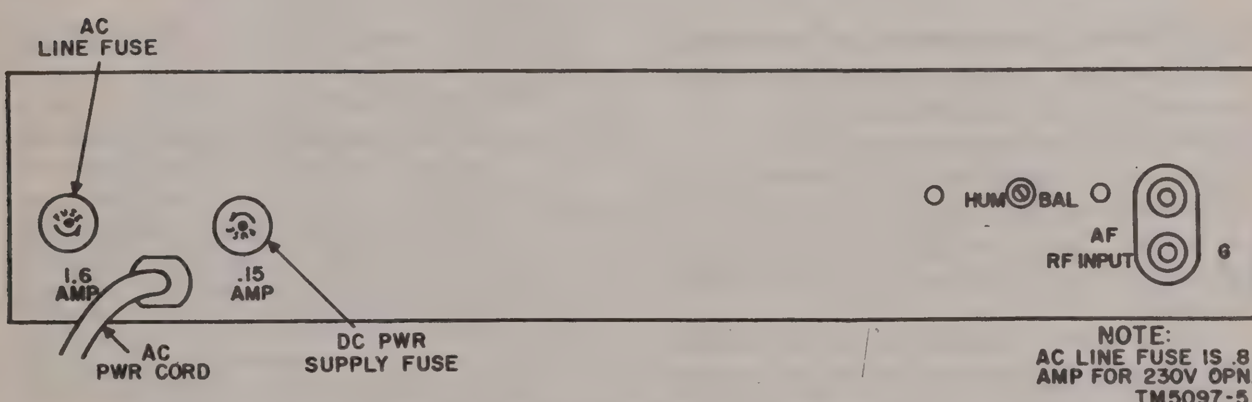


Figure 4. Spectrum analyzer, rear panel view.

17. Starting Procedure

Perform the starting procedure given below before using the operating procedures.

a. Preliminary. Set the front panel controls (fig. 3) as follows:

Control	Position
ON-OFF switch	OFF
Signal INPUT control	MIN
Meter range switch	To approximate level to be measured. If approximate level is not known, set at +50 DB.

Note. To obtain accurate results during operation, ground the spectrum analyzer as instructed in paragraph 14*a*.

b. Starting.

(1) Throw power switch to ON. The tuning dial indicator should glow. Allow equipment to warm up for at least 5 minutes.

(2) Check to see that meter pointer is at 0 on R.M.S. VOLTS scale.

Note. If, during the starting procedure, an abnormal result is obtained, refer to paragraph 39.

18. Distortion Measurements in Percentage

a. Connect test leads from signal source to be measured to AF INPUT binding posts.

b Set AF-RF selector switch to AF.

c. Set meter range switch to 100 percent.

d. Set function switch to SET LEVEL.

e. Slowly rotate signal INPUT control clockwise until meter pointer reaches full scale deflection of 1.0.

f. Set frequency RANGE switch to position which includes fundamental frequency of signal source.

g. Turn function switch to DISTORTION.

h. Adjust coarse FREQUENCY control knob (upper) until meter pointer drops sharply. If the dip cannot be found or is not pronounced, see paragraph 20 for instructions.

i. Adjust fine FREQUENCY control knob (lower) for maximum dip of meter pointer. The tuning becomes sharp as meter reading decreases.

j. Adjust BALANCE control for minimum meter reading. The tuning becomes sharper as meter reading decreases.

Note. The source must put out a stable signal in order to maintain a steady balance.

k. Readjust controls until no further reduction in meter reading can be obtained. As adjustment progresses, decrease setting of meter range switch to maintain midscale meter deflections.

l. Distortion measurements are read on the meter in conjunction with the meter range switch.

19. Distortion Measurements in Db

a. Follow the procedure given in paragraph 18*a* through *f*.

b. Set the meter range switch to +20 DB.

c. Rotate (slowly) signal INPUT control clockwise until meter pointer rests at 0 DECIBELS.

d. Follow the procedure given in paragraph 18*g* through *k*.

e. Distortion measurements are obtained as follows:

(1) When the meter range switch is set at +20 DB position, db distortion measurements can be read directly on the meter.

(2) When the switch is set in any other position, db distortion measurements are obtained by algebraically adding minus 20 db and the DB range setting to the value indicated on the meter.

Note. Db measurements for the +20 DB position can also be obtained by the method given in (2).

(3) Examples of typical db distortion measurements are shown in the chart given below.

1	2	3	4
Db setting of meter range switch	Meter reading	Col 1 plus col 2	Distortion measured Col 3+(−20 db)
−20	−1. 5	−21. 5	−41. 5
0	−1. 5	−1. 5	−21. 5
−30	−1. 5	−31. 5	−51. 5
+10	−1. 5	+8. 5	−11. 5
+20	−1. 5	+18. 5	−1. 5
−20	+1	−19	−39
−30	+1	−29	−49
+10	+1	+11	−9

Note. The maximum possible error in distortion readings is −11 percent of the reading obtained. Distortion readings greater than −20 db, such as −11.5- and −9-db readings shown in column 4 above, are not precise readings but only indicate extreme distortion.

(4) The db range of each position of the meter range switch is shown in the following chart.

DB position	Range in db
−30	−62 to −48
−20	−52 to −38
−10	−42 to −28
0	−32 to −18
+10	−22 to −8
+20	−12 to +2
+30	−2 to +12
+40	+8 to +22
+50	+18 to +32

20. Search for Unknown Input Signal Frequency

When the AF signal frequency to be measured is unknown, proceed as follows:

a. Follow the procedure given in paragraph 18*a* through *e* except to set function switch to DISTORTION.

b. Set frequency RANGE switch to X1.

c. Rotate coarse FREQUENCY knob from 20 through 200 on the FREQUENCY tuning dial and at the same time watch meter pointer for a dip. If there is no dip, set the frequency RANGE switch to X10 and if there is still no needle dip, switch to X100.

d. Follow the procedure in paragraph 17*i* through *k*.

e. The approximate unknown frequency may now be read on the frequency dial multiplied by the designated number of the frequency RANGE switch.

21. Use as Vtvm for Measuring Signals in Rms Values

Note that the AF–RF selector switch, signal INPUT control, frequency RANGE switch, and both FREQUENCY controls have no effect when the spectrum analyzer is operated as standard ac vtvm.

a. Connect test leads from signal source to be measured to METER binding posts.

b. Set function switch to METER.

c.. Increase or decrease setting of the R.M.S. VOLTS designations of the meter range switch to obtain a readable meter indication.

d. Read the indicated voltages on the top or center scale of meter as designated by the meter range switch.

22. Use as Vtvm for Measuring Signals in Dbm Values

a. Follow the procedure in paragraph 21*a* and *b*.

b. Set meter range switch to DB position which gives an easy readable meter indication.

c. If the internal impedance of the signal source being measured is 600 ohms, the dbm level is the meter indication algebraically added to the setting

of the meter range switch. Examples of meter indications are as follows:

1 Setting of DB position of meter range switch	2 Meter indication (DECIBELS scale)	3 Measured signal in dbm (sum of cols. 1 and 2)
0	−5	−5
−10	−5	−15
−20	−5	−25
−30	−5	−35
+10	−5	+5
+20	−5	+15
+20	+1	+21

d. If the internal impedance of the signal source being measured is not equal to 600 ohms, a correction factor must be applied to the meter reading obtained in column *3* (chart in *c* above).

(1) Record the value obtained from the meter.

(2) Refer to the impedance correction chart in figure 5. Find the intersection of impedance of the signal source under measurement and the diagonal line. The closest horizontal line to this intersection is the dbm correction factor.

(3) This correction factor must be algebraically added to the sum of the meter reading and setting of the meter range switch.

(4) Examples of dbm measurements and applied correction factors are as follows:

1 Source impedance in ohms	2 Algebraic sum of meter reading and setting of meter switch in dbm* range	3 Dbm correction factor obtained from fig. 5	4 Corrected dbm reading of actual signal being measured (algebraic sum of cols. 2 and 3)
60	−8	+10	+2
60,000	+4	−20	−16

*See table given in *c* above.

23. Use as Vtvm With Increased Sensitivity

When the function switch is set in the SET LEVEL position, the sensitivity of the spectrum analyzer is increased by a voltage gain of 10 or by a db gain of +20. When this switch is set in the NOISE position, the sensitivity of the spectrum analyzer is increased by a voltage gain of 100 or by a db gain of 40.

a. Connect test leads from signal source to be measured to AF INPUT binding posts.

b. Set AF–RF selector switch to AF.

c. Set function switch to SET LEVEL for 20-db gain (or for a voltage gain of 10) or to NOISE for 40-db gain (or for a voltage gain of 100).

d. Set meter range switch to 10 R.M.S. VOLTS.

e. Slowly advance the signal INPUT control. If meter reading exceeds 10 before the control is turned to MAX, do not use increased sensitivity to make the measurement. When this condition exists, make rms voltage readings as described in paragraph 21 or dbm readings as described in paragraph 22.

f. Set the signal INPUT control to MAX and the meter range switch to R.M.S. VOLTS (*g* below) or DB (*h* below) position to obtain the most readable meter deflection.

g. Compute voltage readings as described in paragraph 21*d*. If function switch is set to SET LEVEL, divide by 10 from the computed reading. If the switch is set to NOISE, divide by 100 from the computed reading.

h. Compute dbm readings as described in paragraph 22*c* and *d*. If the function switch is set to SET LEVEL, algebraically add −20 dbm to the computed reading. If the switch is set to NOISE, algebraically add −40 dbm to the computed reading. For example, if the computed meter reading is −18 dbm and the function switch is set to NOISE, algebraically adding −40 dbm to −18 dbm gives a true reading of −58 dbm.

24. Use of Oscilloscope With Spectrum Analyzer

If an oscilloscope is available, more significant information about the signal source under test can be obtained. The oscilloscope provides the operator with information about the signal source that could give erroneous readings on the spectrum analyzer. Noise, hum, parasitics, stray field pickup, or any other form of extraneous signals will be indicated on the oscilloscope. The oscilloscope is connected to the OSCILLOSCOPE binding posts and may be used with measuring techniques described in paragraphs 18 and 19, and 21 through 23.

25. Stopping Procedure

a. Turn the power switch to OFF.

b. Disconnect the test leads.

c. Disconnect the power cord from the power outlet.

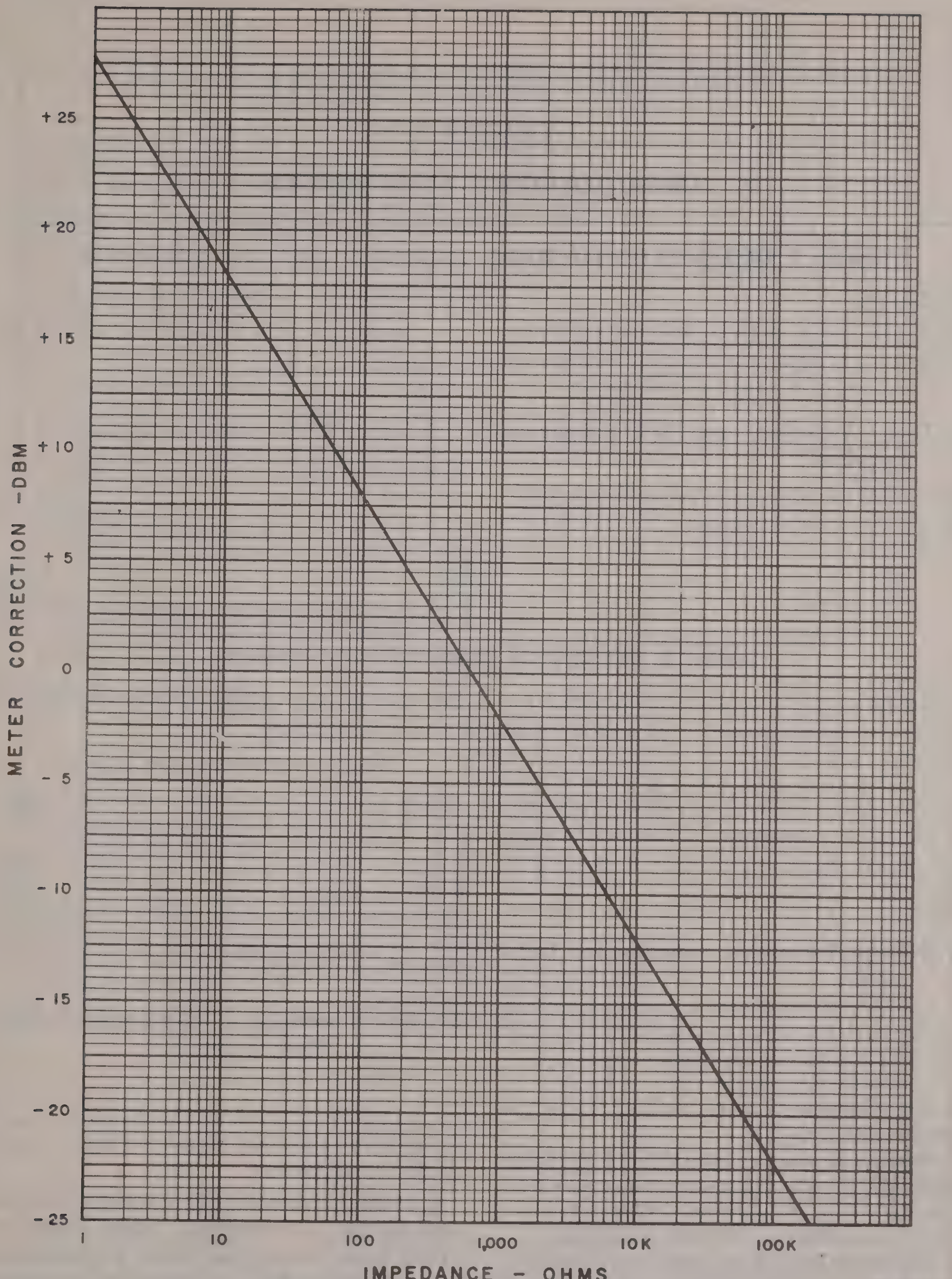


Figure 5. Impedance correction chart.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE

Section I. ORGANIZATIONAL TOOLS, MATERIALS, AND TEST EQUIPMENT

26. General

The tools, parts, supplies, and test equipment necessary to perform organizational maintenance are authorized by appropriate publications.

27. Tools, Materials, and Test Equipment Required

The following tools, materials, and test equipment are required for organizational maintenance procedures:

Nomenclature	Technical manual	Common name
1 Tool Equipment TE-113.	--------------	
Cleaning Compound (Federal stock No. 7930-395-9542).	--------------	
Electronic Multimeter TS-505/U.	TM 11-5111	Vtvm
Multimeter ME-77/U*	--------------	Multimeter
Electron Tube Test Set TV-7/U.	TM 11-5083	Tube tester

*If this multimeter is not available, use Multimeter TS-352/U (TM 11-5527) in its place.

Section II. PREVENTIVE MAINTENANCE SERVICES

28. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from troubleshooting and repair since its object is to prevent certain troubles from occurring.

29. General Preventive Maintenance Techniques

a. Use No. 000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning. If necessary, except for electrical contacts, moisten the cloth or brush with Cleaning Compound; after cleaning, wipe the parts dry with a cloth.

Warning: Prolonged breathing of Cleaning Compound fumes is dangerous. Make sure adequate ventilation is provided. Cleaning Compound is flammable; do not use it near a flame.

c. Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will become damaged or broken.

30. Use of First Echelon Preventive Maintenance Form

(fig. 6)

a. DA Form 11-238 is a preventive maintenance checklist to be used by the operator as directed.

b. Lined out items, or portions thereof, in figure 6 does not apply to the spectrum analyzer. References in the ITEM column refer to paragraphs in text which contain required detailed or additional maintenance information.

31. Use of Second and Third Echelon Preventive Maintenance Form

(fig. 7)

a. DA Form 11-239 is a preventive maintenance checklist to be used by second and third echelon repairmen as directed.

b. Items that do not apply to the spectrum analyzer are lined out on figure 7. References in the ITEM block in the figure are to paragraphs in this manual that contain additional information about the item.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.
SPECTRUM ANALYZER TS-723A/U	

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	S	M	T	W	T	F	S
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT ~~(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).~~							
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.							
3	CLEAN DIRT AND MOISTURE FROM ~~ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS~~, JACKS, PLUGS~~, TELEPHONES, CARRYING BAGS~~, COMPONENT PANELS.							
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: ~~TUBES, LAMPS, CRYSTALS~~, FUSES, ~~CONNECTORS, VIBRATORS~~, ~~PLUG-IN COILS AND RESISTORS.~~							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, ~~WORN OR CHIPPED GEARS~~, MISALIGNMENT, POSITIVE ACTION.							
6	CHECK FOR NORMAL OPERATION. PAR. 32a							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS~~ AND CASES,~~ RACK MOUNTS, ~~SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES~~, AND CABLE CONNECTIONS.		13	~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.~~	
8	INSPECT CASES~~,~~ MOUNTINGS, ~~ANTENNAS, TOWERS,~~ AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE.		14	CLEAN ~~AIR FILTERS, BRASS NAME PLATES,~~ DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.	
9	INSPECT ~~CORD,~~ CABLE, ~~WIRE, AND SHOCK MOUNTS~~ FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN.		15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	
10	~~INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.~~		16	~~INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.~~	
11	~~INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.~~		17	~~CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.~~	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS~~, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS~~, CAPACITORS, ~~GENERATORS~~, AND PILOT LIGHT ASSEMBLIES. PAR. 32b		18	~~CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.~~	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-238 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM5097-30

Figure 6. DA Form 11-238.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS — See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.
SPECTRUM ANALYZER TS-723A/U	

LEGEND FOR MARKING CONDITIONS: *✓ Satisfactory; X Adjustment, repair, or replacement required; ⊗ Defect corrected*
NOTE: *Strike out items not applicable*

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT ~~(receiver, transmitter, carrying cases, wire and~~ cable, ~~microphones, tubes, spare parts, technical~~ manuals, ~~and accessories).~~		19	ELECTRON TUBES ~~INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS; INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES.~~	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.		20	~~INSPECT FILM CUTOUTS FOR LOOSE PARTS, DIRT, MISALINEMENT, AND CORROSION.~~	
3	CLEAN DIRT AND MOISTURE FROM ~~ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS,~~ JACKS, PLUGS, ~~TELEPHONES, CARRYING BAGS, COMPONENT PANELS.~~		21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, ~~CRYSTALS,~~ FUSES, CONNECTORS, VIBRATORS, ~~PLUG-IN COILS, AND RESISTORS.~~ PAR. 32c		22	~~INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALINEMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.~~	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, ~~WORN OR CHIPPED GEARS,~~ MISALINEMENT, POSITIVE ACTION. PAR. 3c (1)		23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALINEMENT OF PLATES, AND LOOSE MOUNTINGS. PAR. 32c (3)	
6	~~CHECK FOR NORMAL OPERATION.~~ PAR. 32b		24	INSPECT RESISTORS, ~~BUSHINGS, AND INSULATORS,~~ FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION, AND MOISTURE.	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, ~~SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES,~~ AND CABLE CONNECTIONS.		25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT, AND LOOSE CONTACTS.	
8	INSPECT CASES, MOUNTINGS, ~~ANTENNAS, TOWERS,~~ AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE.		26	CLEAN AND TIGHTEN SWITCHES, ~~TERMINAL BLOCKS, BLOWERS, RELAY CASES,~~ AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	
9	INSPECT ~~CORD,~~ CABLE, ~~WIRE, AND SHOCK MOUNTS~~ FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN.		27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS, AND BREAKS.	
10	~~INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS, AND REFLECTORS.~~		28	~~CHECK SETTINGS OF ADJUSTABLE RELAYS.~~	
11	~~INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.~~		29	LUBRICATE EQUIPMENT ~~IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.~~ PAR. 32c (4)	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, ~~POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS,~~ CAPACITORS, ~~GENERATORS,~~ AND PILOT LIGHT ASSEMBLIES.		30	~~INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.~~	
13	~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.~~		31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS.	
14	CLEAN ~~AIR FILTERS, BRASS NAMEPLATES,~~ DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.		32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING ~~AND OIL LEAKAGE.~~	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR 32c (2)		33	~~BEFORE SHIPPING OR STORING—REMOVE BATTERIES.~~	
16	~~INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.~~		34	~~INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.~~	
17	~~CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.~~		35	~~INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.~~	
18	~~CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT, AND GREASE.~~		36	~~INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.~~	
			37	MOISTURE AND FUNGIPROOF. PAR. 32c (5)	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 MAY 51 11-239 Replaces DA AGO Form 419, 1 Dec 50, which is obsolete.

TM5097-31

Figure 7. DA Form 11–239.

32. Performing Preventive Maintenance

a. Daily Items. If there is any doubt concerning operation of the spectrum analyzer, proceed to the equipment performance checklist (par. 39).

b. Weekly Items. Disconnect the power cord and then remove the spectrum analyzer from the relay rack. Remove the bottom and top cover and then discharge the filter capacitors (C17 and C18, fig. 20) before proceeding to check the items.

c. Monthly Items.

(1) Check FREQUENCY tuning mechanism (figs. 8 and 25).

(2) Inspect FREQUENCY dial glass for damage.

(3) Do not touch or bend the plates of the variable FREQUENCY tuning capacitor (C13, fig. 19). To do so will result in loss of frequency calibration of the spectrum analyzer.

(4) Lubricate the shafts in accordance with directions given in paragraph 34 and figure 8. Note this is done quarterly.

(5) Slide the top cover into the panel-chassis assembly and attach it with the four screws. Slide the bottom cover into the panel-chassis assembly and attach it with the four screws. Replace the spectrum analyzer in the relay rack. Upon completion of these procedures, reconnect the power and check for satisfactory operation of the test set.

Section III. LUBRICATION

33. General

(fig. 8)

The type of lubricant to be used, the interval, and specific instructions for lubricating the moving parts of the spectrum analyzer are given in figure 8 and paragraph 34.

34. Lubrication Instructions

a. Gasoline will not be used as a cleaning fluid for any purpose. When the spectrum analyzer is overhauled or repairs are made, clean the parts with Cleaning Compound.

b. Do not use excessive amounts of oil and do not allow connections to become greasy.

c. Be sure that lubricants and points to be lubricated are clean and free from sand, grit, or dirt. Use Cleaning Compound to clean all parts. Before lubrication, clean all surfaces to be lubricated; use a lint-free cloth dampened with Cleaning Compound. Keep Cleaning Compound off surrounding parts.

d. Lubrication intervals designated are for daily 8-hour periods of operation. For longer periods of operation, intervals should be shortened.

Section IV. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

35. General

a. Troubleshooting and repairs at the organizational maintenance level are limited only by the tools, materials, test equipment, replaceable parts authorized at this level, and by the skill of the repairman.

b. Organizational troubleshooting techniques include visual inspection, tube replacement procedures, and procedures for sectionalizing troubles to a stage within the unit (pars. 38 and 39).

36. Visual Inspection

a. Failure of this equipment to operate properly usually will be caused by one or more of the following faults:

(1) Worn, broken, or disconnected power cord or plug.

(2) Burned-out fuses.

(3) Power cord not grounded properly.

(4) Defective tubes (par. 37).

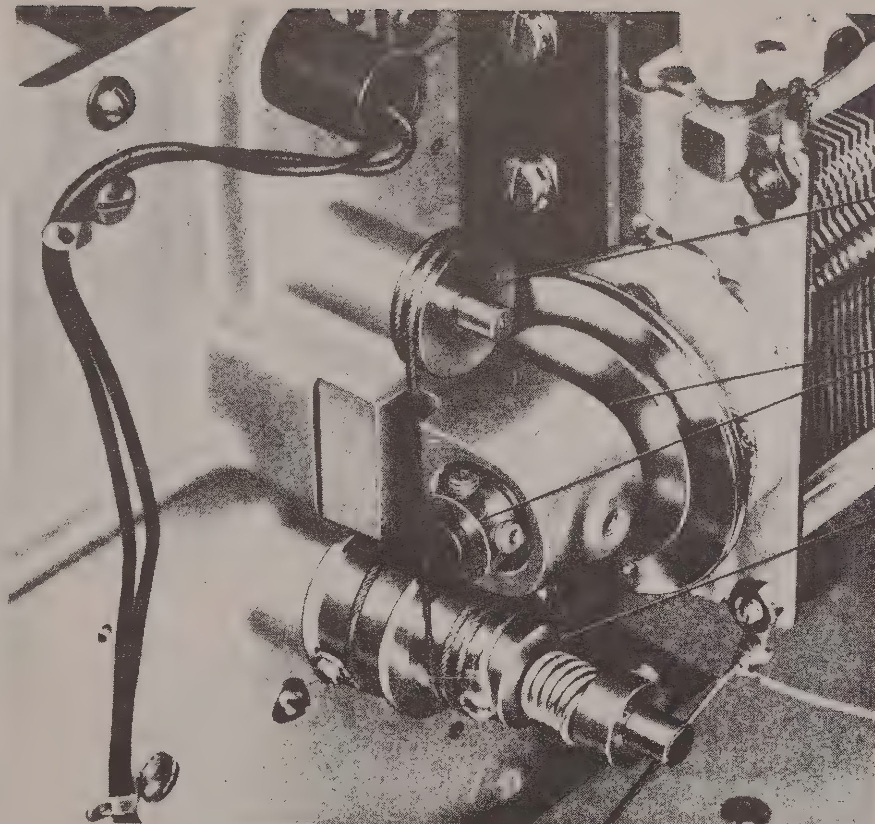
b. When failure is encountered and the cause is not immediately apparent, check the above items before starting a detailed examination of the component parts of the spectrum analyzer. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

37. Electron Tube Replacement Techniques

Note. Do not check emission of tubes until all other tests indicate a defective tube.

To prevent discarding good electron tubes as faulty, follow the procedures given below when troubleshooting the spectrum analyzer.

a. Inspect all cabling and the general condition of the spectrum analyzer before removing the electron tubes.



KEY

LUBRICANT	INTERVAL
OAI -- OIL, LUBRICATING, AIRCRAFT AND INSTRUMENTS.	Q -- QUARTERLY. OR WHEN DISASSEMBLED FOR REPAIR.

TM 5097-9

Figure 8. Lubrication of spectrum analyzer.

b. Isolate the trouble, if possible, to a particular section of the spectrum analyzer. (Use the equipment performance checklist (par. 39) as a guide.)

c. If a tube tester (par. 27) is on hand, remove and test one tube at a time. Substitute new tubes only for those that are defective. (This step may be performed after following the procedure outlined in *d* below.)

Warning: If the spectrum analyzer has been operating for some time, use a cloth when removing the tubes to prevent burning of hands or fingers.

d. If a tube tester is not on hand, troubleshoot the spectrum analyzer by the substitution method.

(1) Replace one of the *suspected* tubes with a new tube.

(2) Check to see whether the spectrum analyzer is operative.

(3) If the spectrum analyzer is operative, discard the original tube.

(4) If the spectrum analyzer is inoperative, remove the new tube and reinsert the original tube.

(5) Continue to check the suspected tubes, using the procedure given in (1) through (4) above, until the spectrum analyzer becomes operative.

e. If the spectrum analyzer is inoperative after the procedure outlined in *a* through *d* above is completed, continue as follows:

(1) Replace all of the suspected tubes, one at a time, with new ones until the spectrum analyzer becomes operative. Note the sockets from which the original tubes were removed. When the spectrum analyzer begins to operate, discard the last tube removed.

Note 1. Some circuits may function with one tube and not another even though both tubes are new. If practicable, retain a removed tube until its condition is checked by a suitable test instrument.

Note 2. It is possible to remove V6 from the frequency selective amplifier section of the equipment without affecting the operation of the vtvm section (fig. 9). If there is an insufficient number of spare tubes, this tube may be removed and used to troubleshoot the defective section.

(2) Reinsert the remaining original tubes, one at a time, in the original sockets. If the spectrum analyzer fails to operate during this step, discard the original tube last reinserted. *Do not leave a new tube in a socket if the spectrum analyzer operates satisfactorily with the original tube.*

Note. If a replacement for a bad tube soon becomes defective, continued tube replacement will result in more tubes becoming defective. *Troubleshooting must be performed before continuing.*

f. If tube substitution does not correct the trouble, *reinsert the original tubes in the original sockets* before forwarding the defective spectrum analyzer for higher echelon repair.

g. As a general rule discard tubes when—

(1) A test by a tube tester or other instrument shows that a tube is defective.

(2) The tube defect is obvious. For example, the glass envelope is broken, the filament is open, or a connecting prong or lead is broken.

h. Do not discard tubes merely because the tubes have been used for a specified length of time. *Satisfactory operation in a circut is the final proof of the tube quality.* The tube in use may work better than a new one.

i. Do not discard tubes merely because they fall on, or slightly above, the minimum acceptable value when checked in a tube tester. Some new tubes fall near the low end of the acceptable range; yet these tubes may provide satisfactory performance throughout a long period of operational life at this *near limit* value.

38. Troubleshooting by Using Equipment Performance Checklist

a. Purpose and Use. The equipment performance checklist is the beginning of a systematic troubleshooting technique designed to isolate trouble with a minimum of waste effort. Operate the equipment as directed in the checklist, check for the normal indications listed, and, if an abnormal indication is obtained, follow the corrective measure outlined in the final column of the checklist.

b. Corrective Measures. In a few cases, the nature of the possible abnormal indications permits immediate localization of trouble to a particular part, so that the corrective measure indicates the specific part to be repaired or replaced. In most mases, however, the possible abnormal indications provide only for sectionalization of the trouble to a particular unit or group of parts. In these latter cases, the corrective measures call for the performance of additional testing proce-

dures in order to localize the trouble. When the procedure referred to is beyond the scope of organizational maintenance personnel, reference is made to specific paragraphs in this manual, and troubleshooting at a field maintenance level is required.

39. Equipment Performance Checklist

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Ac line fuse.	Correct size for line voltage.	1.6 amp for 115V; 0.8 amp for 230V.	
	2	Dc power supply fuse.	Correct size.	0.15 amp.	
	3	Power transformer	Proper strapping for line voltage.	Refer to paragraph 13.	
	4	AC power switch.	Turn to ON.	Pilot lamp lights.	Check ac line fuse (fig. 4) in rear panel receptacle. Check line cord and plug. Check strapping of power transformer (T1).
EQUIPMENT PERFORMANCE	5	Meter range switch.	Turn to —30 DB.		
		Function switch.	Set to METER.		
		METER bindpost.	Unscrew upper binding post and touch metal part of binding post with finger.	Pointer on meter deflects clockwise and pins against right stop.	Check tubes V7, V8, V9, V10, V11, V12, V13 and V14 (fig. 19).
	6	AF-RF selector switch.	Set to AF.		
		Signal INPUT control.	Set to MAX.		
		Frequency RANGE switch.	Turn to X1.		
		Meter range switch.	Set to 3.0 R.M.S. VOLTS.		
		Function switch.	Set to NOISE.		
		AF INPUT binding post.	Unscrew upper binding post and touch metal part of binding post with finger.	Pointer on meter deflects clockwise and pins against right stop.	Check tubes V2, V3, V4, V5 and V6 (fig. 19).
	7	AF-RF selector switch.	Set to AF.		
		Signal INPUT control.	Set to MAX.		
		Frequency RANGE switch.	Set to X1.		
		Meter range switch.	Set to 1.0 R.M.S. VOLTS.		
		Function switch.	Set to SET LEVEL.		
		AF INPUT binding post.	Unscrew upper binding post and touch metal part of binding post with finger.	Pointer on meter deflects clockwise and pins against right stop.	Check function switch (S4, fig. 19). Refer to par. 54, item No. 5.
	8	AF-RF selector switch.	Set to AF.		
		Signal INUPT control.	Set to MAX.		
		Frequency RANGE switch.	Set to X1.		
		Meter range switch.	Set to 1.0 R.M.S. VOLTS.		
		Function switch.	Set to DISTORTION.		
		AF INPUT binding post and FREQUENCY tuning knobs.	Unscrew upper binding post and touch metal part with finger, and adjust FREQUENCY tuning control knobs until the meter reads zero (approx 60 cps). Adjust BALANCE control for exact zero reading.	Meter reads zero.	Bridge circuit. Refer to par. 58*c*.

CHAPTER 5

THEORY

40. Block Diagram

The block diagram for Spectrum Analyzer TS–723A/U is shown in figure 9. For more detailed overall circuit information see figure 28. The spectrum analyzer consists of three major circuits: a frequency selective amplifier, a vacuum-tube voltmeter (vtvm) circuit, and a power supply.

a. Frequency Selective Amplifier Section. The frequency selective amplifier section consists of a three-stage preamplifier, a Wien bridge (hereafter named *bridge*) circuit, and a bridge amplifier. The preamplifier stage amplifies the incoming signals and passes them to the bridge. The bridge may be switched in or out of the circuit as required. When switched into the circuit, it is tuned to reject the fundamental frequency of the incoming signal and allows all of the remaining harmonics to pass through to the bridge amplifier. When it is switched out of the circuit, all frequencies in the incoming signal are passed from the preamplifier directly to the bridge amplifier. The bridge amplifier amplifies the output of the bridge when the bridge is switched into the circuit and acts as the final two stages of amplification when the bridge is switched out of the circuit. The bridge is responsive to input signals having fundamental frequencies from 20 to 20,000 cps. When the spectrum analyzer is used as a vtvm, the bridge is switched out of the circuit and the frequency selective amplifier may be used as a 20- or 40-db gain amplifier for the vtvm circuit. The gain of the amplifier is controlled by the amount of negative feedback applied to the input of the preamplifier from the output of cathode follower V6 in the bridge amplifier. The negative feedback is controlled by an adjustable feedback network. When the function switch is set to SET LEVEL, the negative feedback is attenuated enough to establish 20-db maximum gain in the combination of the preamplifier and bridge amplifier. When the switch is set to NOISE, the maximum gain of the two amplifiers is 40 db. When the spectrum analyzer is used for making distortion readings, the bridge is first switched out of the circuit. A reference reading is obtained on the meter in the voltmeter circuit. Then the bridge is switched into the circuit and is tuned to reject the fundamental frequency, thus allowing the remaining harmonics to be measured. The meter reading obtained is then the percent of distortion, or the db difference, between the fundamental frequency and its harmonics.

b. Vtvm Section. The vtvm section consists of a voltage divider stage (V11), a two-stage voltage amplifier (V12 and V13), and a meter rectifier circuit (V14). The voltage divider stage V11 is basically a cathode follower tube with multitapped cathode resistors R58 and R88 (fig. 16). This stage provides a high input impedance for the vtvm section. The two-stage voltage amplifier amplifies the output of the voltage divider stage and applies this amplified ac voltage to the meter rectifier circuit. Meter rectifier tube and meter M1 provide the negative feedback path (fig. 17) for returning output voltage back to the input of amplifier V12. This negative feedback voltage controls the gain of the amplifier. Tube V14 functions as a full-wave rectifier and converts the ac output voltage of the two-stage voltage amplifier to the dc voltage required for actuating the meter. The meter is a milliammeter calibrated in rms volts and decibels. The vtvm circuit may be used independently of the frequency selective amplifier. When used in this way, the input signals to be measured are connected to the METER binding posts and fed directly into the voltage divider circuit.

c. Power Supply. The power supply circuit supplies regulated and unregulated B+ voltages to the other circuits in the spectrum analyzer. Incoming ac line voltage passes through power transformer T1 (fig. 18). Stepped up ac voltage obtained from the high-voltage secondary windings of T1 is rectified in full-wave rectifier V7.

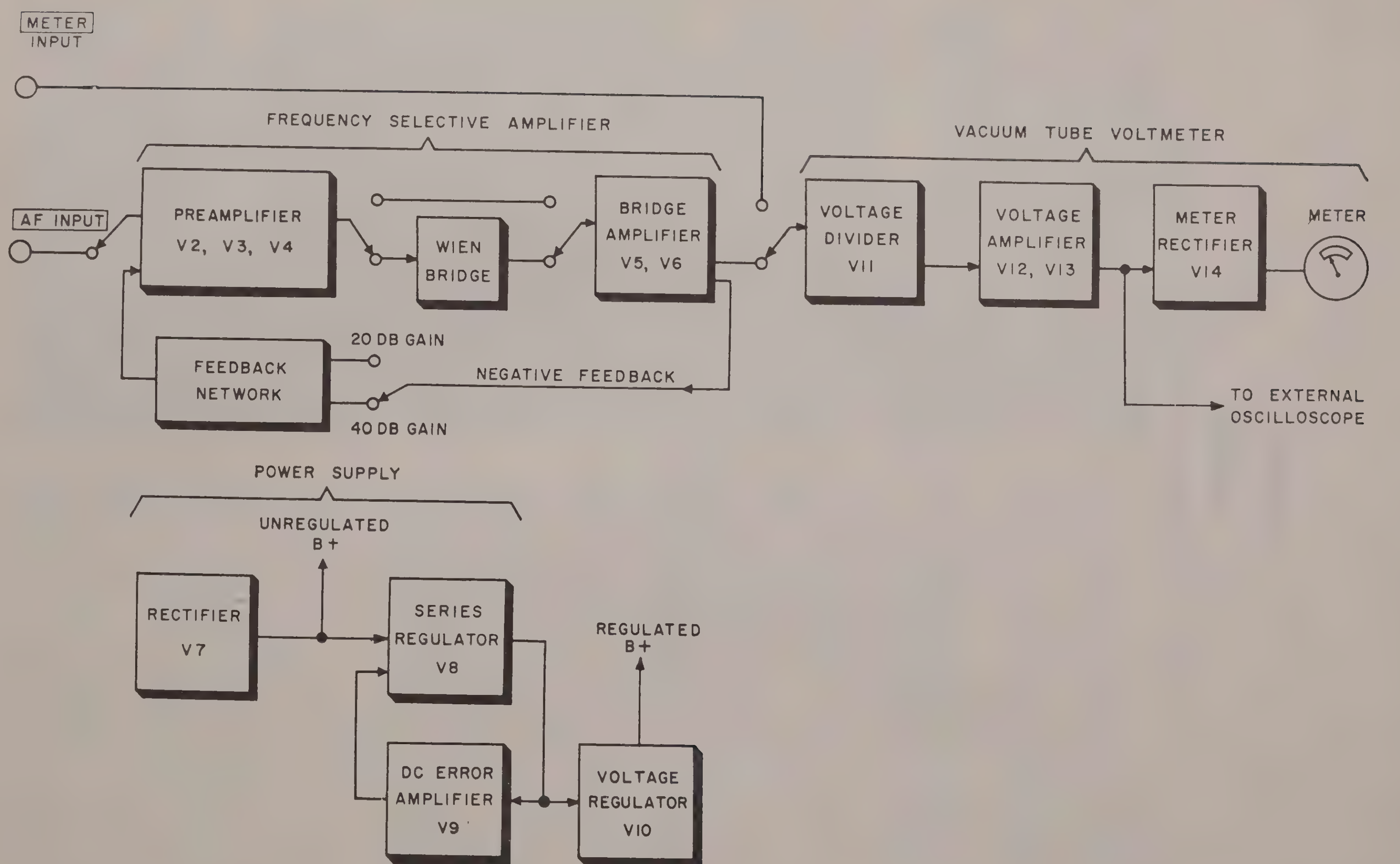


Figure 9. Spectrum analyzer, block diagram.

Unregulated B+ voltage (after the filter) from V7 is supplied to the vtvm circuit and to serjes regulator V8. Tube V8 supplies regulated B+ to the amplifier circuits. A dc error amplifier circuit, consisting of dc error amplifier V9 and voltage regulator V10, controls the output of V8.

41. Preamplifier Circuit

a. Figure 10 is a simplified schematic diagram of the preamplifier circuit. Input signals to the preamplifier circuit may be connected to AF INPUT binding posts E7 and E8 or to AF–RF INPUT binding posts E5 and E6. AF–RF selector switch S2 provides selective switching between the AF INPUT binding posts and AF–RF INPUT binding posts. When S2 is the RF position, the AF–RF INPUT binding posts are connected to the input of the preamplifier circuit through C6. AF INPUT binding posts E7 and E8 are used to connect audiofrequency signals. Binding posts E5 and E6 are used when measuring the modulating frequency of an amplitude modulated radiofrequency carrier.

b. Tube V2 is the first voltage amplifier. Signal INPUT control R4 is a variable resistor which adjusts the level of the signal applied through C7 to the grid of V2. Operating bias for V2 is obtained from the voltage drop produced across R9. Resistor R8 is the grid return. Resistors R6 and R7, and variable resistor R5 (NOISE GAIN) determine the amount of negative feedback returned to V2 from the output of bridge amplifier tube V6. Resistor R6 and R5 are switched in or out of the circuit by switch S4B of the function switch S4. When these resistors are switched out of the circuit, R7 and R9 form a divider network for the negative feedback voltage. The resultant gain of the combined preamplifier and bridge amplifier circuits is 20 db. When R5 and R6 are switched into the circuit, they form a divider network in combination with R7 and R9 which adjusts the overall gain of the preamplifier and bridge amplifier circuits to 40 db. Resistor R5 is used to adjust the overall gain of the preamplifier and bridge amplifier at 40 db. This control is adjusted during calibration and alinement of the spectrum analyzer and does not normally require readjustment. Resistor R10 is the plate load for V2. Screen voltage of V2 is reduced by a voltage divider consisting of R11 and R12. Resistors R13 and R90 (par. 58*e*) provide a negative feedback path between the cathodes of V2 and V4. The output of the V2 is coupled to V3 through C8.

c. Tube V3 is the second voltage amplifier. Operating bias is produced by the voltage drop across R15. Resistor R14 is the grid return. Screen grid voltage is provided by the voltage divider formed by R16 and R18. Resistor R17 is the plate load for V3. The output of V3 is coupled to V4 through C10.

d. Tube V4 is the third amplifier stage and operates as a cathode follower. Resistor R19 is the grid return for this stage. Operating bias is produced by the voltage drop across R20, in the fixed resistive arm of the bridge (fig. 11). The output of V4 is obtained at the cathode. This output is applied to the input of V2 as additional negative feedback and to the junction of the fixed resistive arm and series reactive arm in the bridge circuit.

42. Wien Bridge Circuit

a. Figure 11 is a simplified schematic diagram of the bridge. The bridge circuit operates as a variable frequency rejection filter. It has a fixed resistive arm, a variable resistive arm, a series reactive arm, and a shunt reactive arm. The fixed resistive arm consists of R20 and R21. The variable resistive arm consists of fixed resistors R24, R25, and R22, and variable resistors R89 and R23. Resistor R89 is the range setting balancing chassis control which is adjusted during alinement of the spectrum analyzer and does not normally require readjustment. Variable resistor R23 is the BALANCE control and is adjustable from the front panel.

b. Resistors R1, R26, R3, R27, R39, and R28 are connected by frequency RANGE switch S3 in pairs according to the frequency range selected. These resistors form a part of the series reactive arm. For the X1 frequency range, R1 and R26 form the series resistance for the arm. For the X10 frequency range, R3 and R27 form the series resistance for the arm. For the X100 frequency range, R39 and R29 form the series resistance for the arm. Variable FREQUENCY tuning capacitor C13 is a four-section tuning capacitor. Capacitor C13A and C13B are connected in parallel in the series reactive arm. Capacitor C13A and C13B are connected in parallel in the shunt reactive arm of the bridge. Trimmer capacitor C12 provides a vernier tuning adjustment of the series reactive arm of the bridge to calibrate the FRE-

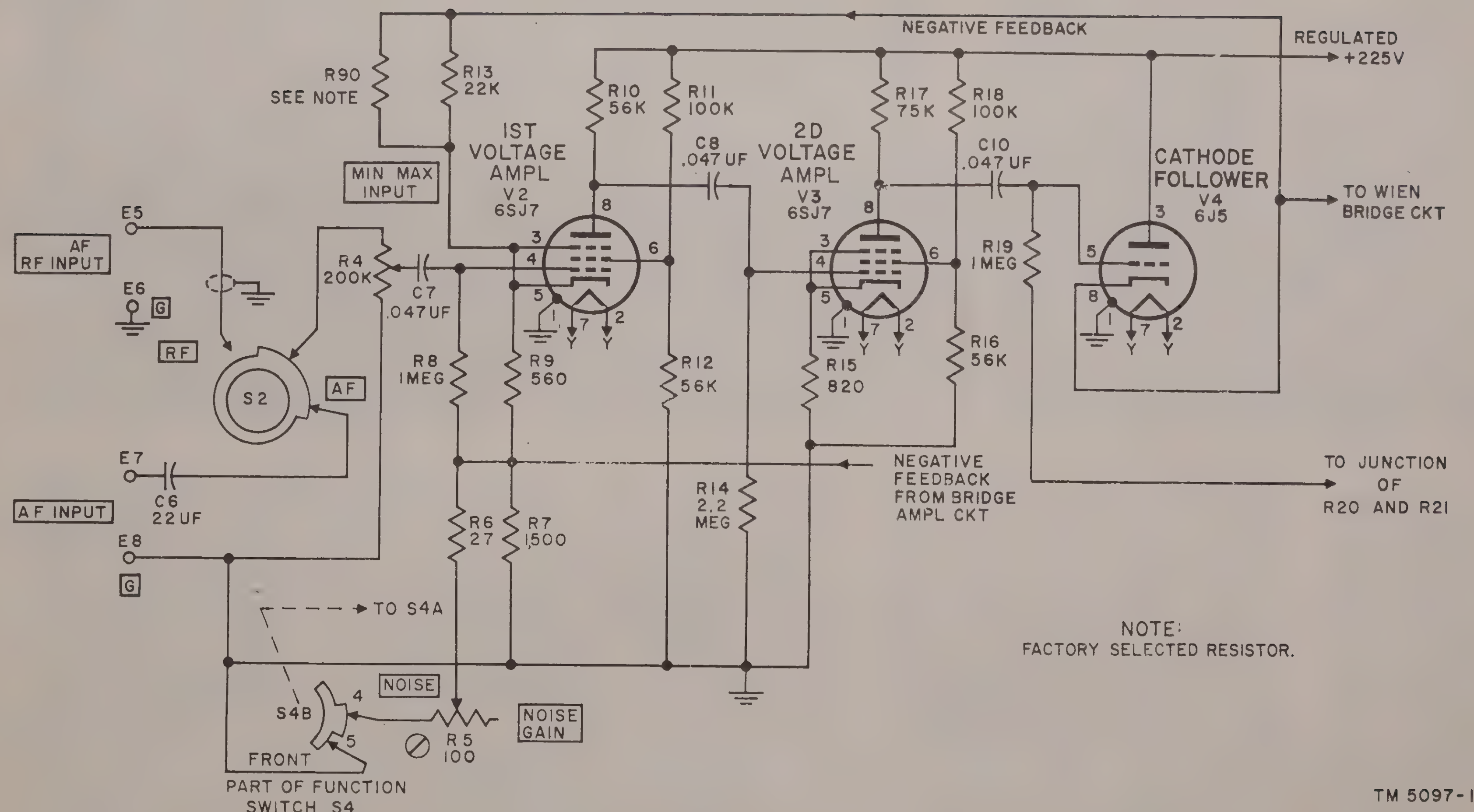


Figure 10. Preamplifier circuit, simplified schematic diagram.

QUENCY tuning dial. Fixed capacitor C14 compensates for the effect of the input capacitance of V5 in the bridge amplifier circuit.

c. Resistors R47, R29, R91, R30, R2, and R31 are connected by switch S3 in pairs according to the frequency range selected. These resistors form a part of the shunt reactive arm of the bridge. For the X1 setting of switch S3, resistors R2 and R31 are connected to form a series resistance for the shunt reactive arm. For the X10 setting of S3, R30 and R91 are connected to form a series resistance for the arm and for the X100 setting of S3, R29 and R47 are connected to form a series resistance for the arm.

d. Variable FREQUENCY tuning capacitor C13 is mechanically controlled by two knobs on the front panel (fig. 3), one for coarse FREQUENCY settings of the capacitor and one for fine FREQUENCY adjustments. Capacitor C13 is used to select the exact rejection frequency of the bridge.

e. The bridge is never physically disconnected from the circuit. Operation of function switch S4A to the SET LEVEL or NOISE position places a ground at the junction of the series reactive arm and shunt reactive arm (fig. 15). . This disables the frequency rejection characteristic of the bridge.

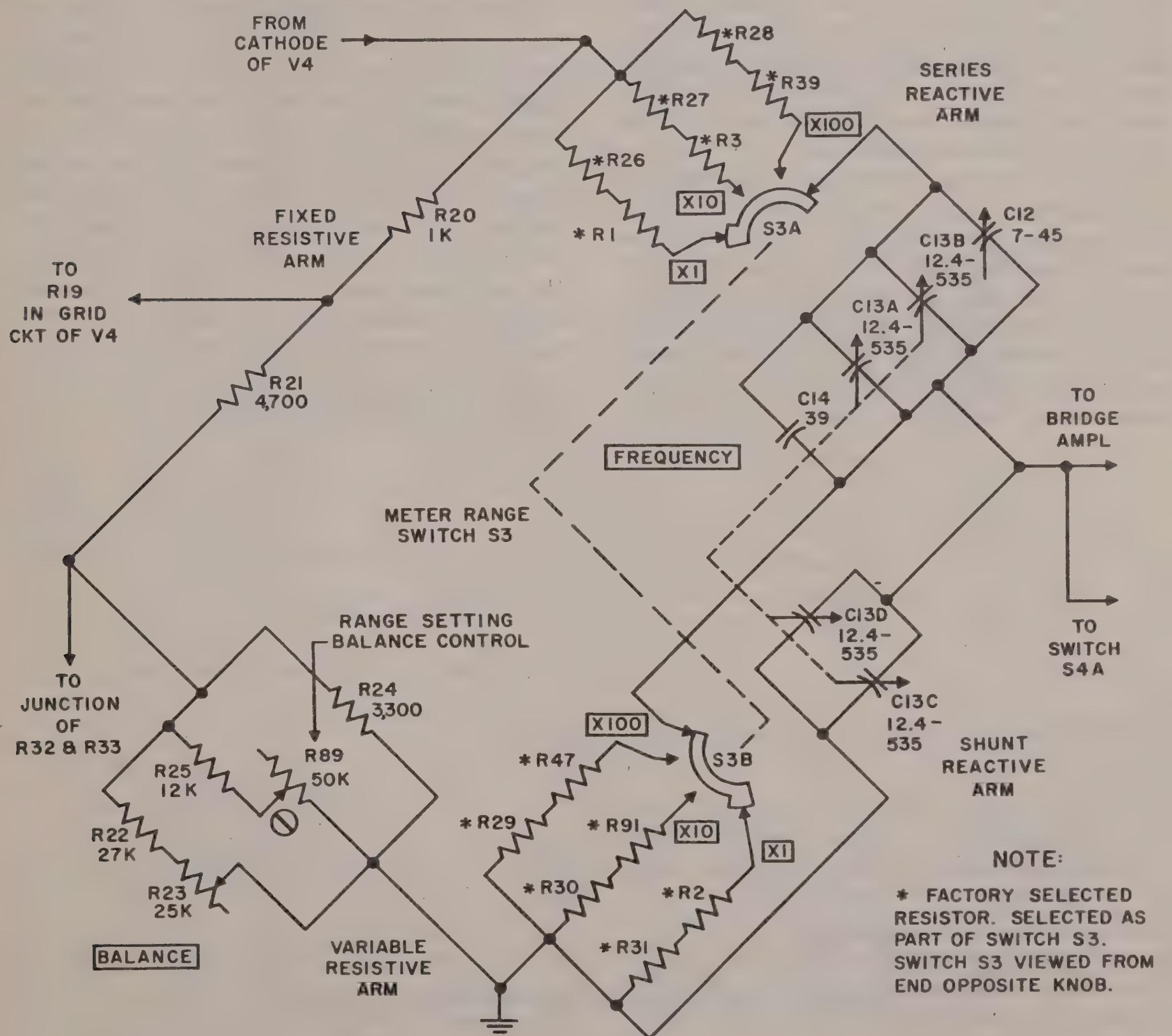


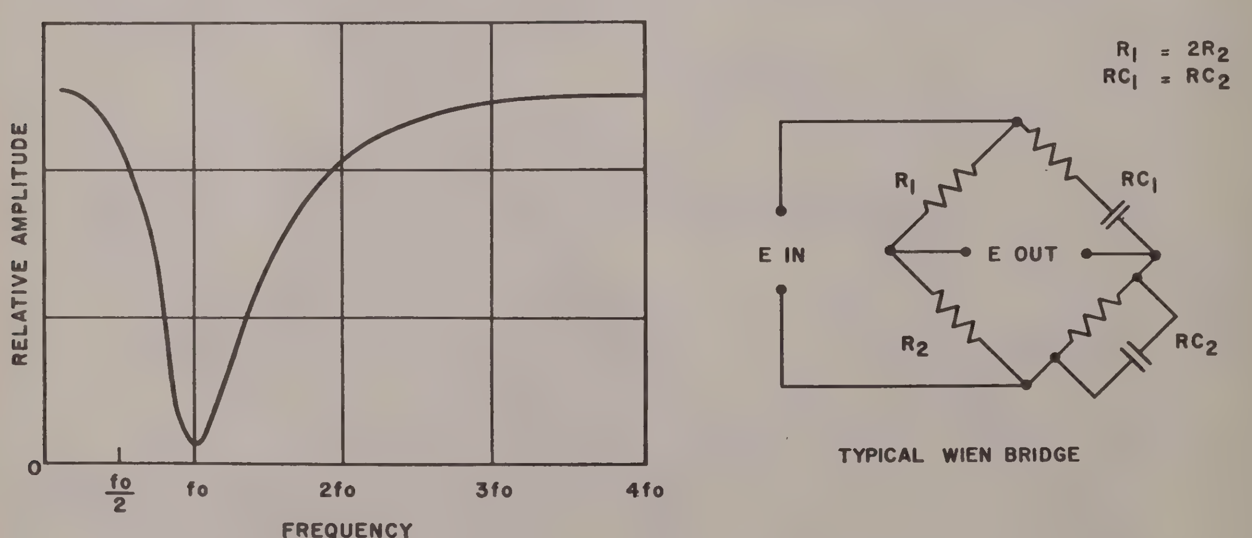
Figure 11. Bridge circuit, simplified schematic diagram.

43. Bridge as Frequency Rejection Filter

a. The sharp frequency rejection property of the bridge is obtained from the combined characteristics of the resistance-capacitance networks in the bridge and vacuum-tube circuits contained in the preamplifier and bridge amplifier. Figure 12 shows the frequency rejection characteristics of the bridge. The equivalent circuit diagram of the bridge in the figure shows the conditions that exist in the bridge to give the frequency rejection characteristics shown in the graph. In this diagram, RC_1 represents the series reactive arm of the bridge, RC_2 represents the shunt reactive arm, R_1 represents the fixed resistive arm, and R_2 represents the variable resistive arm. When the bridge is adjusted to reject a given fundamental frequency, RC_1 must be equal to RC_2, and R_1 must be equal to two times R_2. It can be seen from the graph that the skirt rejection characteristic of the bridge does not have a steep slope.

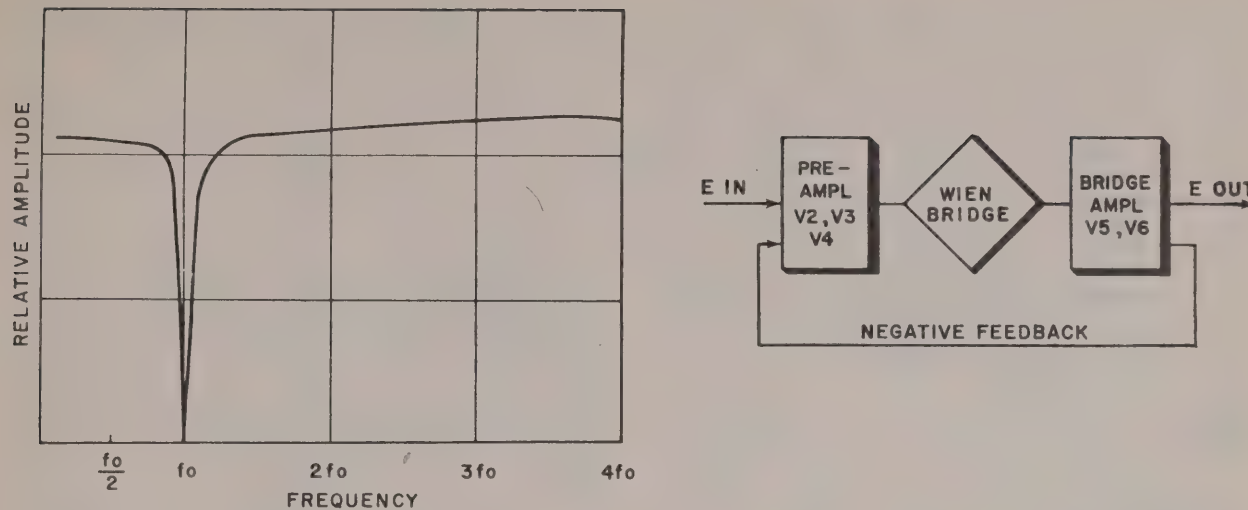
b. When the bridge is inserted as the interstage coupling element in an inverse feedback amplifier, the rejection characteristics of the bridge are greatly improved. When the bridge is used in this way, the phase, as well as the amplitude response, can be utilized. Figure 13 shows how the rejection characteristics of the bridge are improved when the bridge is inserted as the coupling component in a feedback amplifier. The feedback amplifier attains maximum negative feedback when the returned function of the output signal is impressed at the input circuit in opposite phase to the original signal. This condition exists only for the frequency being rejected (fo) as illustrated in figure 14 because the bridge imparts considerable phase shift to other frequencies.

c. Only V2 and V3 produce 180° phase displacements. This establishes proper phase orientation for the negative feedback loop. There is little departure from exact phase opposition between the feedback signal and the original input signal because of the combined action of the preamplifier and the bridge amplifier when the bridge is excluded from the circuit. Therefore, the relative phase of the feedback voltage is governed by the bridge. More negative feedback exists in the amplifier for the frequency being rejected and the gain of the amplifier is less for this frequency than for the remaining frequencies. Therefore, through its effect on feedback, the bridge causes the amplifier gain to be reduced for the frequency being rejected (fo). Both phase and amplitude characteristics combine to decrease the attenuation of other frequencies. Therefore, the bridge in conjunction with the amplifiers produces a much sharper frequency rejection curve than is obtained from the bridge alone.



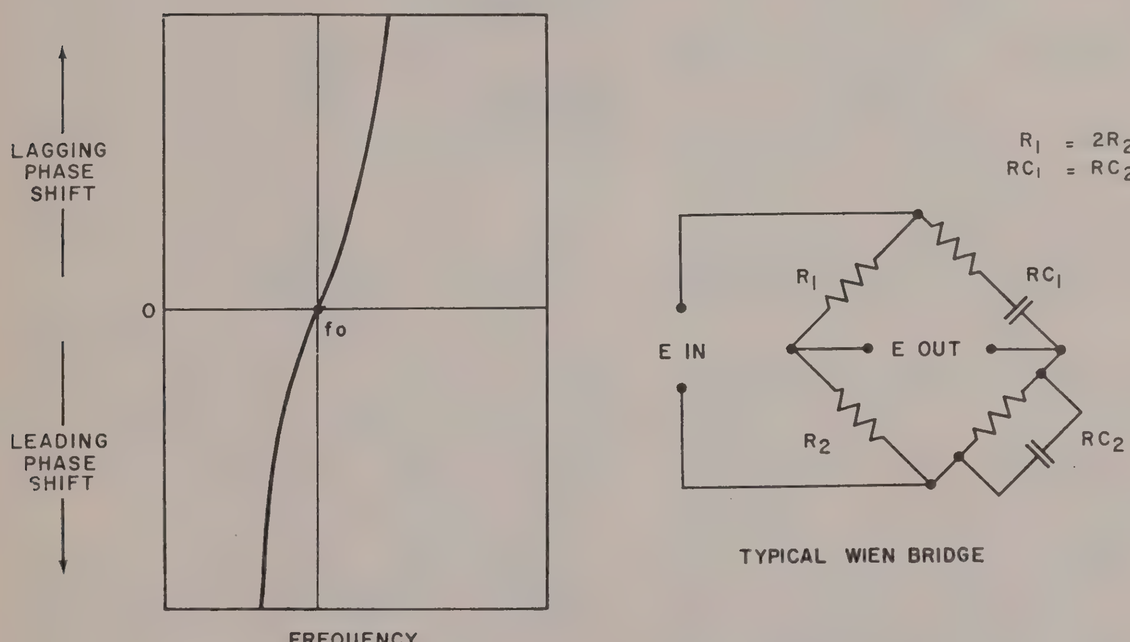
TM 5097-14

Figure 12. Frequency rejection characteristics of the bridge.



TM 5097-15

Figure 13. Frequency rejection characteristics of the bridge when used with feedback amplifier.



TM 5097-16

Figure 14. Phase shift characteristics of bridge.

44. Bridge Amplifier Circuit

a. Figure 15 is a simplified schematic diagram of the bridge amplifier circuit. Tube V5 is the phase amplifier for the bridge amplifier circuit. The input signal to this tube is obtained from the bridge and is applied to both the control grid and the cathode. The grid connection to the input signal is made to the junction of the series and shunt reactive arms of the bridge through C32. The cathode connection to the input signal is made to the junction of the resistive arms of the bridge. At the rejection frequency of the bridge, no net signal voltage appears at the input of V5.

b. Operating bias for V5 is produced by the voltage drop across R33. Resistor R32 is the grid return. Resistor R34 is the plate load. Resistor R35 is the screen grid voltage dropping resistor. Capacitor C15 bypasses the screen grid to ground. When switch S4A is set in the SET LEVEL or NOISE positions, V5 is converted to a grounded

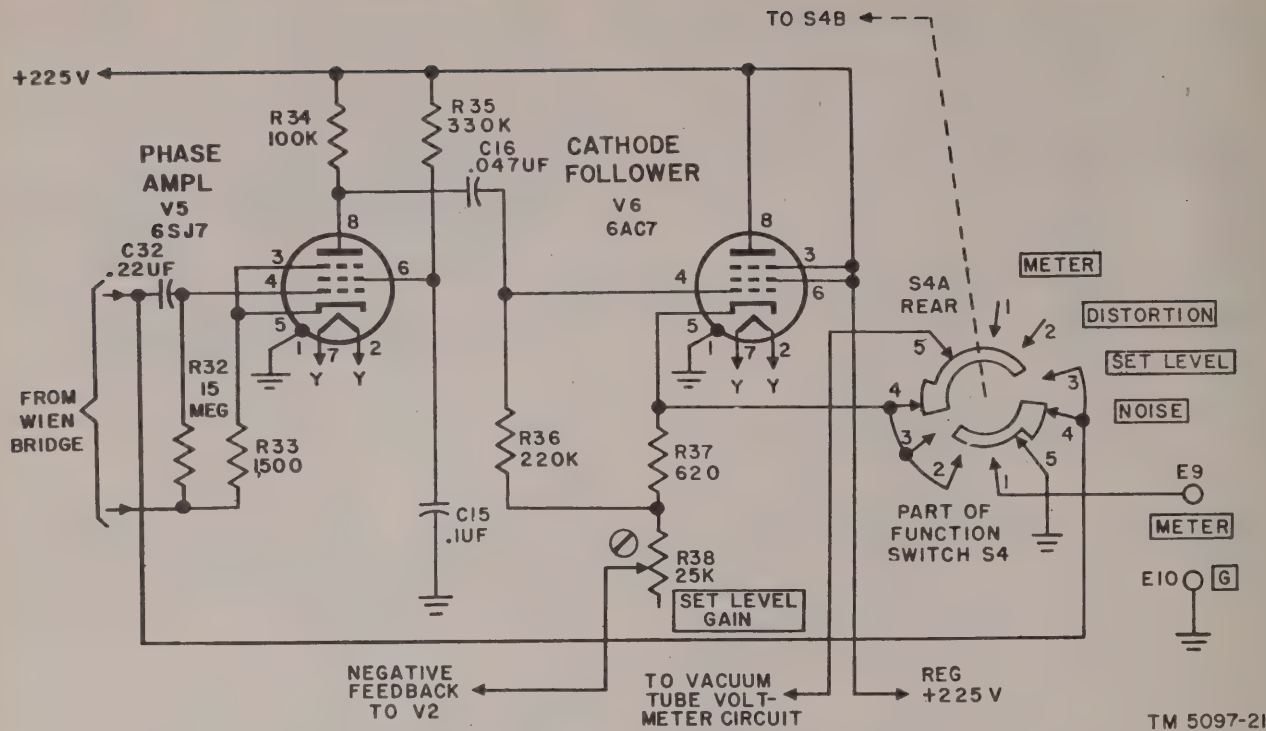


Figure 15. Bridge amplifier circuit, simplified schematic diagram.

grid amplifier. Under this condition, the reactive arms (fig. 11) of the bridge are shorted to ground and there is no rejection frequency. The output of V5 is passed through C16 to the control grid of V6.

c. Cathode follower V6 is the output stage of the bridge amplifier. The screen grid and suppressor grid of V6 are connected at the plate so that the tube functions essentially as a triode. Operating bias is produced by the voltage drop across R37. Resistor R36 is the grid return. SET LEVEL control R38 adjusts the feedback voltage obtained at the cathode of V6 and returned to V2. This provides gain control of the combination of the preamplifier and bridge amplifier circuits, when the function switch S4 is set in the SET LEVEL position.

45. Function Switch S4 and Db Gain of Spectrum Analyzer (fig. 15)

Rotary switch S4A has four switching positions. The setting of this switch determines the type of operation of the spectrum analyzer as follows:

a. When S4A is in the METER position, the preamplifier, bridge, and bridge amplifier circuits are disconnected from the vtvm circuit. In this position, incoming signals are connected to the METER binding posts and the spectrum analyzer is operated as a standard vtvm.

b. When S4A is placed in the DISTORTION position, it inserts the frequency selective amplifier ahead of the vtvm circuit. In this position, the fundamental frequency of the signal being measured is rejected by the bridge and only the remaining harmonics pass through the bridge amplifier to the vtvm circuit.

c. When S4A is in the SET LEVEL position, it shorts the bridge circuit to ground so that the preamplifier and bridge amplifier circuits operate as a straight five-tube amplifier with 20-db gain. In this position, all incoming frequencies are passed from the output of the bridge amplifier to the vtvm circuit.

d. When S4A is in the NOISE position, the bridge circuit is shorted to ground so that the preamplifier and bridge amplifier circuits operate as a straight five-tube amplifier with 40-db gain. When S4A is in the NOISE position, switch S4B (fig. 10) is automatically placed in the NOISE position as well since both switches are on the same shaft. This brings NOISE GAIN control R5 and R6 into the negative feedback circuit from V6 thus attenuating the feedback voltage which, in

turn, increases the gain of the amplifier circuits. In this position, all incoming frequencies are passed from the output of the bridge amplifier through the switch contacts to the vtvm circuit.

46. Voltage Divider Circuit

a. Figure 16 is a simplified schematic diagram of the voltage divider circuit. Tube V11 is a cathode follower with a multisection series resistance, R88 and R58, conected in its cathode circuit. This tube and its accompanying circuitry provide a high input impedance for the vtvm section and make possible adjustment of the frequency response for different voltage ranges. Taps on R88 and R58 are connected to the switch contacts of switch section S6C. Meter range switch S6 has nine positions for selecting various voltage and db ranges.

b. When S6 is set in the 0.30, 1.0, 3.0, 10, or 30 R.M.S. VOLTS position, the incoming signals pass through C22 to the grid of V11.

c. When S6 is set in the 0.10 R.M.S. VOLTS position, switch S6B brings trimmer C25 into the cathode circuit of V11. Trimmer C25 provides control of the high-frequency response for this voltage range.

d. When S6 is set in the 100 or 300 R.M.S. VOLTS position, the incoming signals pass through a network consisting of the series combination of R52 and R77 (par. 58*d*(13)) in parallel with trimmer C20 before passing through C22 to the grid of V11. For the 300 R.M.S. VOLTS setting, switch S6A switches in the network consisting of the series combination of R53 and R78 (par. 58*d*(20)), in parallel with C24 and C23. Resistors R53, R78, R57, R52, and R77 form a voltage divider which reduces the level of the incoming signal before it is passed through C22 to the grid of V11. Trimmer C20 is used to adjust the high-frequency response for the 100 R.M.S. VOLTS setting. Trimmer C23 is used to adjust the high frequency response for the 300 R.M.S. VOLTS setting. Capacitor C24 reduces the effect of C20 on the high-frequency response for the 300 R.M.S. VOLTS setting.

e. Resistors R88 and R58 form part of the cathode-biasing network. The net grid bias is determined by the combination of R58, R88, and R57 in conjunction with the series combination of R54 and R55. Resistor R54 is also used in combination with C21 to form a filter to isolate the grid circuit from the power supply. Resistor

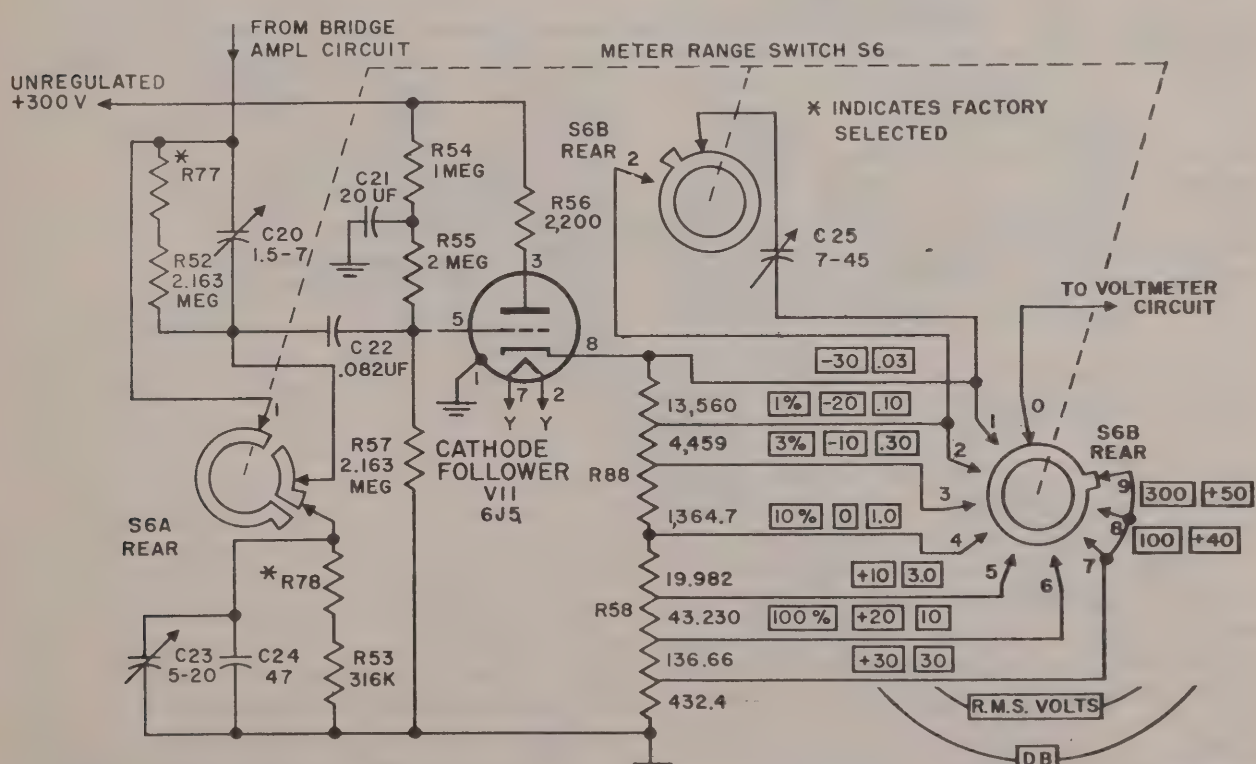


Figure 16. Voltage divider circuit, simplified schematic diagram.

R56 is connected to the plate of V11 to improve the frequency response. At high frequencies, R56 is partially bypassed by tube and stray capacitances. It, therefore, consumes a smaller part of the available tube output voltage and the output voltage developed across R88 and R58, rises. This rise in high-frequency response approximately offsets the drop in high-frequency response caused by shunt capacitances in the input and output circuits. The output of the voltage divider circuit is passed to the grid of V12 through C26.

47. Voltage Amplifier and Meter Circuit

a. Figure 17 is a simplified schematic diagram of the voltage amplifier and meter circuit. Tube V12 is the first voltage amplifier of the vtvm circuit. Grid bias for V12 is obtained from the negative bias supply through R59. Resistor R64 is the plate load for V12. Resistor R65 is the screen grid voltage dropping resistor. The parallel combination of C28A and C28B bypasses the screen grid variations to ground. The output of V12 is passed to V13 through C29. Resistor R75 is a grid limiting resistor.

b. Tube V13 is the output voltage amplifier of the vtvm circuit. Grid bias for V13 is obtained from the negative bias supply through R66. Resistor R68 is the plate load and R69 is the screen grid voltage dropping resistor. The parallel combination of C28C and C28D bypasses the screen grid to ground. The output of V13 is passed through C30 and applied to the plate of V14A through R73 and to the cathode of V14B through R74. The output of V13 is also connected to OSCILLOSCOPE binding post E11.

c. Tube V14 is a full-wave rectifier which converts the ac voltage output of V13 to dc for operation of meter M1. Tube V14B provides conduction for the negative portion of the ac cycle. Tube 14A provides conduction for the positive portion of the ac cycle. Meter M1 is a milliammeter calibrated in R.M.S. VOLTS and DECIBELS. The sensitivity of the meter is 1,000 ohms per volt or 1 ma for full-scale reading. Capacitor C31 filters out the ac component appearing across the meter terminals.

d. A negative feedback loop is obtained at the output of V14. This negative feedback voltage is fed back to the input of V12. Its function is

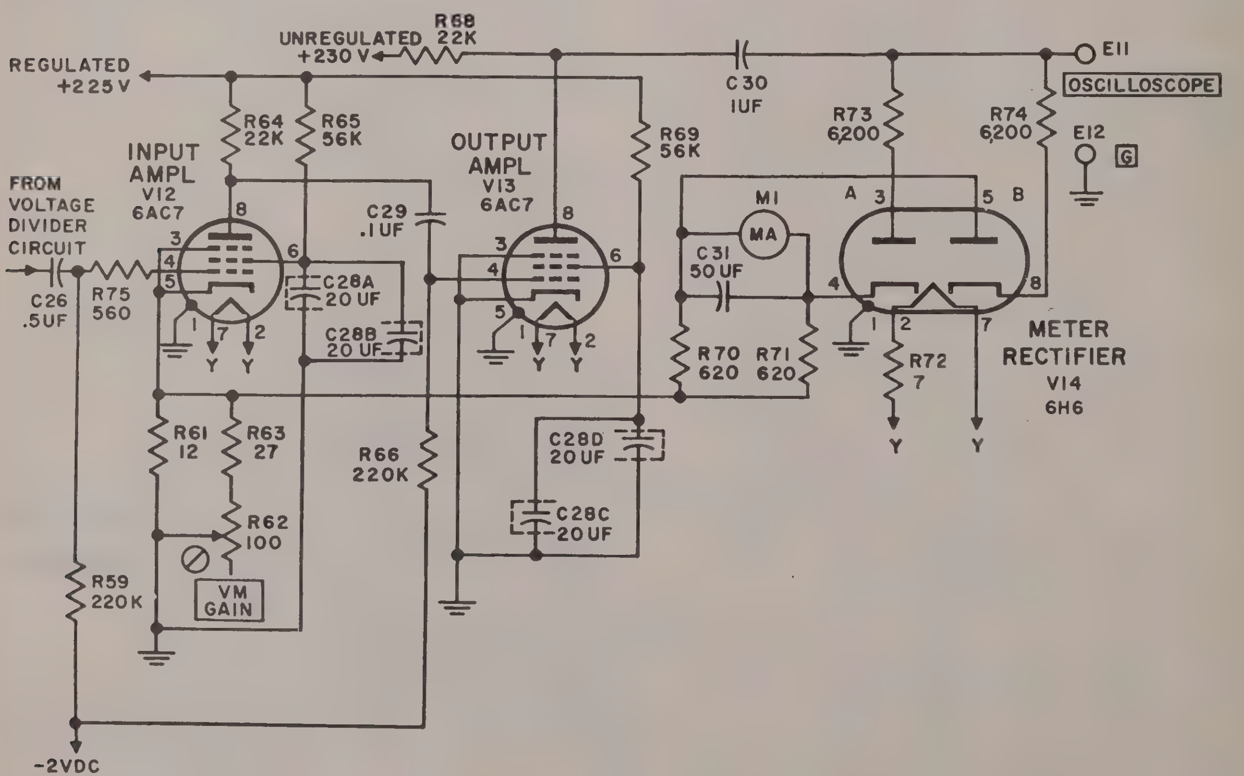


Figure 17. Voltage amplifier and meter circuit, simplified schematic diagram.

to improve frequency response and to stabilize the operation of the vtvm circuit. The amount of feedback voltage establishes the gain of the voltage amplifier circuit. During the positive portion of the ac cycle, the feedback loop is completed through R71. During the negative portion of the ac cycle, the feedback loop is completed through R70. The amount of feedback voltage applied to the grid of V12 is governed by a network consisting of R61, R62, and R63. Variable resistor R62 (VM GAIN) is used to adjust the amount of feedback voltage.

e. Resistor R72 is inserted in the filament circuit of V14 to limit the thermal emission of the tube. Excessive thermal emission would produce an appreciable tube current in the absence of a signal which would interfere with zero-setting of the meter. Resistor R72 also stabilizes V14 with respect to line voltage variations and protects the meter from overload currents.

48. Power Supply Circuit

Figure 18 is a simplified schematic diagram of the power supply circuit. The power supply circuit operates as follows:

a. The ac line voltage is stepped up by the high-voltage secondary winding of T1. Tube V7 provides full-wave rectification of the stepped up voltage. The pulsating dc output of V7 is passed through a filter consisting of C37, C17A and C17B, and reactor L1. Capacitors C37, C17A, and C17B are connected in a series parallel combination to obtain operation with a safe dc working voltage. Resistors R84 and R85 equalize the voltage distribution across these capacitors and at the same time act as a bleeder circuit. The filtered dc voltage is passed through an additional filtering network consisting of R49, R50, R51, C17C, C17D, C18A, and C18B. It is then supplied to the voltage divider stage of the vtvm section at +300 volts dc.

b. Filtered dc voltage from V7 is also applied to the plate of series regulator V8. The output of V8 is obtained at the cathode. This output is governed by the control voltage applied to the control grid of the tube. This control grid voltage is, in turn, controlled by the conductive state of error amplifier V9. Tube V8 supplies the regulated +225 volts for the plate circuits of the frequency selector circuit and V12. The output of V8 is fed through a voltage divider network to the grid of V9. The voltage divider network consists of R44, R42, and R43. Voltage adjust control R43 is used to vary the amount of voltage applied to the grid of V9 from this source. Voltage regulator V10 is connected in the cathode circuit of V9. The stabilized voltage drop across V10 provides V9 with a reference bias. Screen grid voltage for V9 is provided by the voltage divider formed by R86 and R87. Resistor R48 is the plate load for V9 and the grid return for V8. Resistor R46 limits the ionization current of V10.

c. When the dc output voltage from V8 increases, the grid bias voltage applied to V9 from V8 becomes more positive causing higher plate current for V9. The increased plate current flows through R48 resulting in a decrease in plate voltage in V9. The plate voltage of V9 determines the grid bias voltage of V8. When the plate voltage of V9 becomes less positive, the control grid of V8 receives a more negative bias. This increases the effective dc resistance of V8 and lowers the output B+ voltage. Thus, the voltage change responsible for this sequence of events is counteracted.

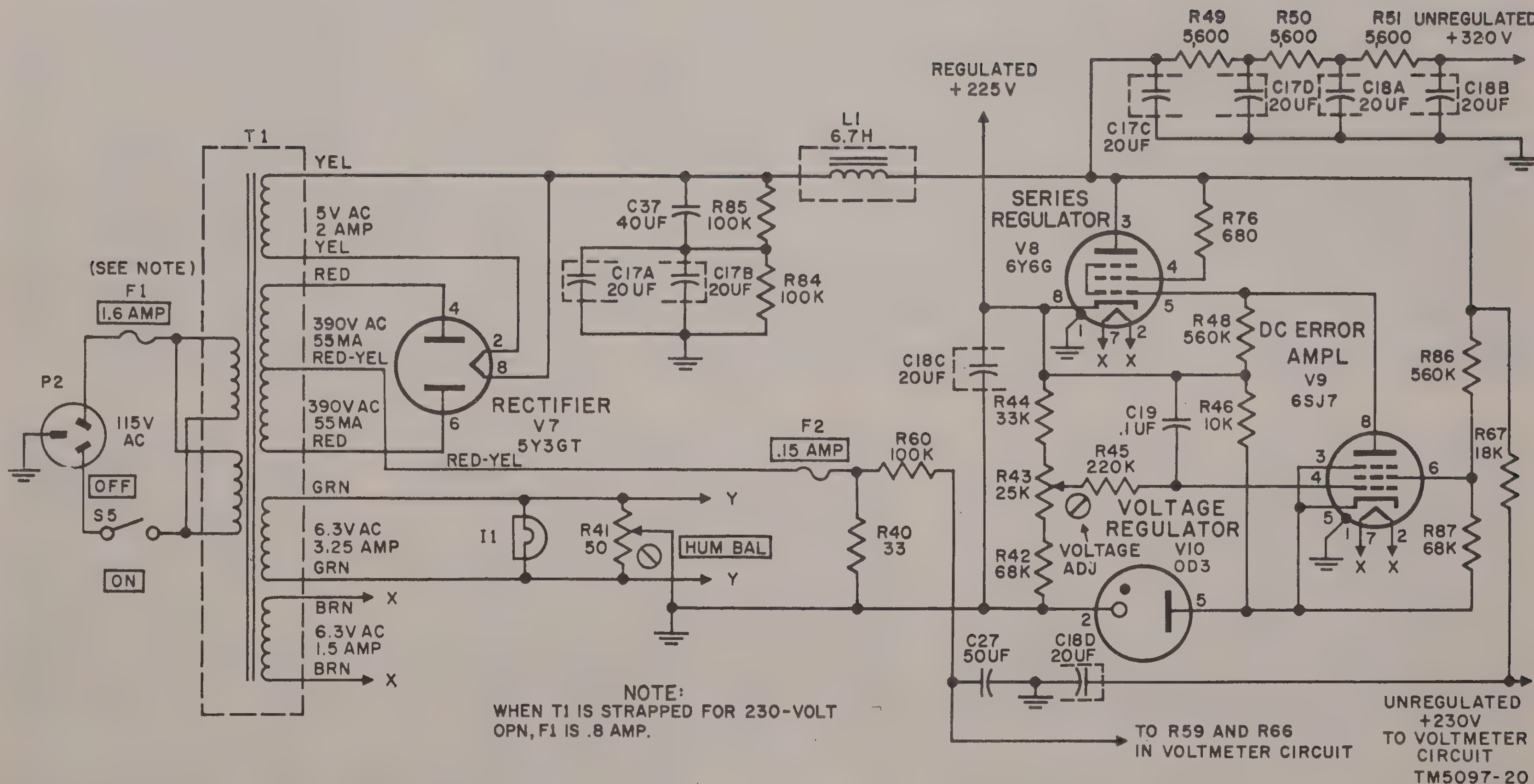
d. When the output voltage of V7 decreases, the grid bias voltage applied to V9 from V8 becomes more negative to decrease the plate current of V9. The decreased plate current flows through R48 and results in an increase in plate voltage in V9. Grid voltage supplied to V8 from V9 becomes less negative which decreases the effective dc resistance of V8 and increases the output of B+ voltage.

e. Resistor R45, in conjunction with C19, forms a network for applying residual ripple voltage directly to the grid of V9. As a result, the regulating characteristic of V8, V9, and V10 produces cancellation of ripple voltage, makes the regulator circuit insensitive to transients. Capacitor C18C provides additional filtering for the regulated output of V8.

f. A negative bias supply is obtained by insertion of R40 between the center tap of the high-voltage secondary winding of T1 and ground. This places the transformer center tap at a negative potential with respect to ground. The bias voltage is filtered by R60 in conjunction with C27. It is then applied as grid bias to V12 and V13.

g. Variable resistor R41, HUM BAL, is used to adjust the effective ac potential point of the frequency selective amplifier and vtvm filament circuit. It is used primarily to minimize hum produced in these filament circuits.

h. Resistor R67 is inserted in the output unregulated supply to reduce the unregulated voltage



NOTE:
WHEN T1 IS STRAPPED FOR 230-VOLT
OPN, F1 IS .8 AMP.

Figure 18. Power supply circuit, simplified schematic diagram.

to +230 volts for application to the plate circuit of V13. Capacitor C18D provides filtering for the +230 volts dc supply.

i. When the ac source is 230 volts, the primary of T1 has to be changed from two windings in parallel for 115-volt operation to one winding in series (fig. 28). As the current path through each winding is 0.8 ampere, fuse F1 must be rated for twice that value or 1.6 amperes for 115-volt operation, and 0.8 ampere for 230-volt operation. Refer to paragraph 13 for instructions on how to convert T1 for either type of operation.

CHAPTER 6

FIELD MAINTENANCE

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

Warning: Be very careful when handling or testing any part of the spectrum analyzer while it is connected to the power source.

49. Troubleshooting Procedures

a. General. The first step in servicing a defective spectrum analyzer is to sectionalize the fault. Sectionalization means tracing the fault to the major component or circuit responsible for the abnormal operation of the spectrum analyzer. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, arcing, and shorted transformer, often can be located by sight, smell, and hearing. The majority of faults, however, must be localized by checking voltages and resistances.

b. Component Sectionalization and Localization. Listed below is a group of tests arranged to simplify and reduce unnecessary work and aid in tracing a trouble to a specific component. The simple tests are used first. Those that follow are more complex. Follow the procedure in the sequence given. In general, the trouble is traced to a section of the spectrum analyzer and the faulty component in that section is located; then the trouble is remedied. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection (par. 36) is to locate any visible trouble. Through inspection alone, the repairman frequently may discover the trouble or determine the circuit in which the trouble exists. This inspection is valuable in avoiding additional damage to the spectrum analyzer which might occur through improper servicing methods and in forestalling future failures.

(2) *Operational test.* The equipment performance checklist (par. 39) is important because it indicates the general location of trouble. In many instances, the information gained will determine the exact nature of the fault. To utilize this information fully, all symptoms must be interpreted in relation to one another.

(3) *Troubleshooting chart.* The trouble symptoms listed in this chart (par. 54) will aid greatly in localizing trouble.

(4) *Signal substitution.* Signal substitution is not generally used for troubleshooting in this equipment. However, if the proper signal generators are available, it is possible to use signal substitution to an advantage in some cases.

(5) *Intermittents.* In all these tests, possibility of intermittent conditions should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. It is possible that some external connection may cause the trouble. Test wiring for loose connections and move wires and components with an insulated tool, such as a pencil or fiber rod. This may show where a faulty connection or component is located.

50. Troubleshooting Data

The use of the material supplied in the manual will help in the rapid location of faults. Consult the following troubleshooting data:

Fig. No.	Title
19	Top view of chassis.
20	Bottom view of chassis.
21	B+ voltage distribution.
22	Tube socket voltage and resistance diagram.
23	Terminal board voltage and resistance diagram.
28	Main schematic diagram.
29	Wiring diagram.

51. Test Equipment Required for Troubleshooting

The following test equipment is required in addition to the test equipment required for organizational maintenance (par. 27):

Test equipment	TM No.	Common name
Audio Oscillator TS–382A/U.	TM 11–2684A	AF oscillator
Oscilloscope OS–8A/U	TM 11–1214	Oscilloscope

52. General Precautions

Observe the following precautions very carefully whenever servicing the spectrum analyzer.

a. Be careful when the bottom cover is removed from the panel-chassis assembly of the spectrum analyzer, dangerous voltages are exposed.

b. If the spectrum analyzer has been operating for some time, use a cloth when removing the tubes to prevent burning the hand or fingers.

c. When servicing the Wien bridge assembly, do not disturb the placement of parts and be careful not to bend the tuning capacitor plates. This could cause a short circuit or a change of alinement.

d. Do not overtighten screws when assembling mechanical couplings.

e. When changing a component that is held by screws, always replace the lockwashers.

f. Careless replacement of parts often makes new faults inevitable. Before a part is unsoldered, note the position of the leads. If the part, such as a power transformer or multitapped switch, has a number of connections, tag each lead.

g. Do not disturb any of the alinement adjustments unless it definitely has been determined that the trouble is caused by an adjustment.

53. Checking B+ Circuits

a. After the unregulated B+ line leaves the filter section of the power supply, it is passed to the voltage divider circuit of the vtvm section. If the voltage is low at pin 3 of V11, or if there is no voltage, it is likely that the trouble lies in the power supply circuit. This may be due to faulty rectifier V7, filter choke L1 open, or filter capacitors C17 or C18 shorted. The methods to be used for checking the circuits are given in *b* through *f* below. Refer to the simplified diagram (fig. 21) of the B+ distribution throughout the spectrum analyzer and of the possible paths which could offer short circuits. By using this diagram in conjunction with the voltage and resistance measurements (figs. 22 and 23), the typical causes for trouble can be checked easily.

b. A trouble in any circuit will be noticed when following the operating procedures in chapter 3. These troubles will be indicated in the equipment performance check list (par. 39). Normally, using this procedure will narrow down the location to a section of the spectrum analyzer or, perhaps, even to one particular stage. Sometimes, if the B+ circuit is shorted in the plate circuit of one stage, it may drop the voltage so that several stages are affected. Most of the checking can be accomplished from the bottom of the chassis. If the voltages supplied from the power supply circuit to the other circuits in the spectrum analyzer are too high or too low, erroneous or erratic meter readings may be obtained. When making repairs or shooting trouble in the spectrum analyzer, always check the power supply output voltages as described in *c* through *f* below before putting the equipment back into service. Use the multimeter for making the voltage readings.

c. The voltage at pin 3 of V8 should be at least +400 volts dc. If a close reading is not obtained, check V7C, C17 and C37, R84 and R85, and L1.

d. The voltage at the junction of C18D and R68 should be at least +230 volts. If a close reading is not obtained, check C18D and R67.

e. The voltage at the junction of R51 and C18B should be at least +300 volts dc. If a close reading is not obtained, check C17C, C17D, C18B, R49, R50, and R51.

f. The voltage at pin 8 of V8 should be +225 volts dc. If this reading is not obtained or if it is a few volts too high or too low, adjust R43 until

the +225-volt dc reading is obtained. If adjustment of R3 does not correct the voltage reading, check V8, V9, and V10 and their associated circuit components.

Note. When the spectrum analyzer is being operated from a 115-volt ac power source, the regulated +225-volts dc obtained at pin 8 of V8 must be between 223 and 227 volts dc for a variation in line voltage of 102 to 128 volts ac. If the spectrum analyzer is being operated from a 230-volt ac power source, the regulated +225 volts dc obtained at pin 8 of V8 must be between 223 and 227 volts dc for a line variation of 204 to 256 volts ac.

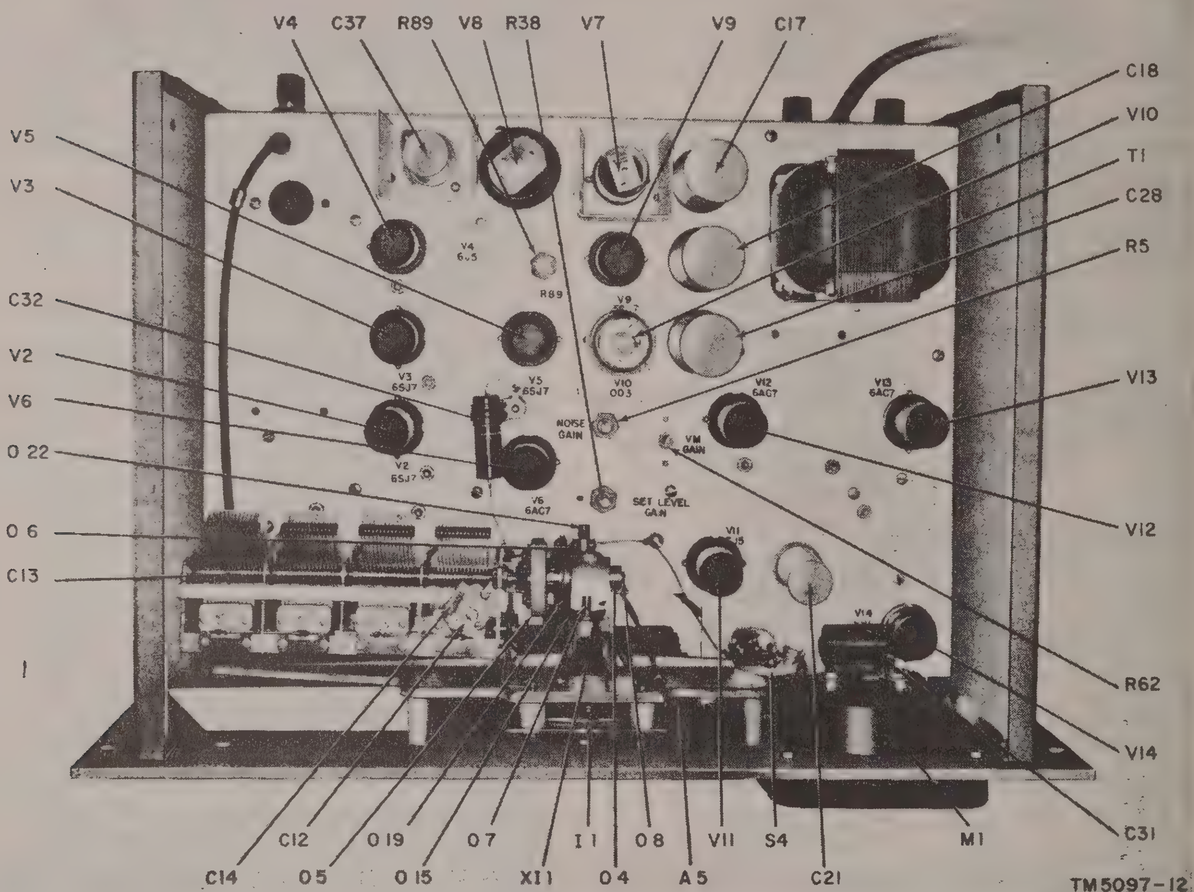


Figure 19. Top view of chassis.

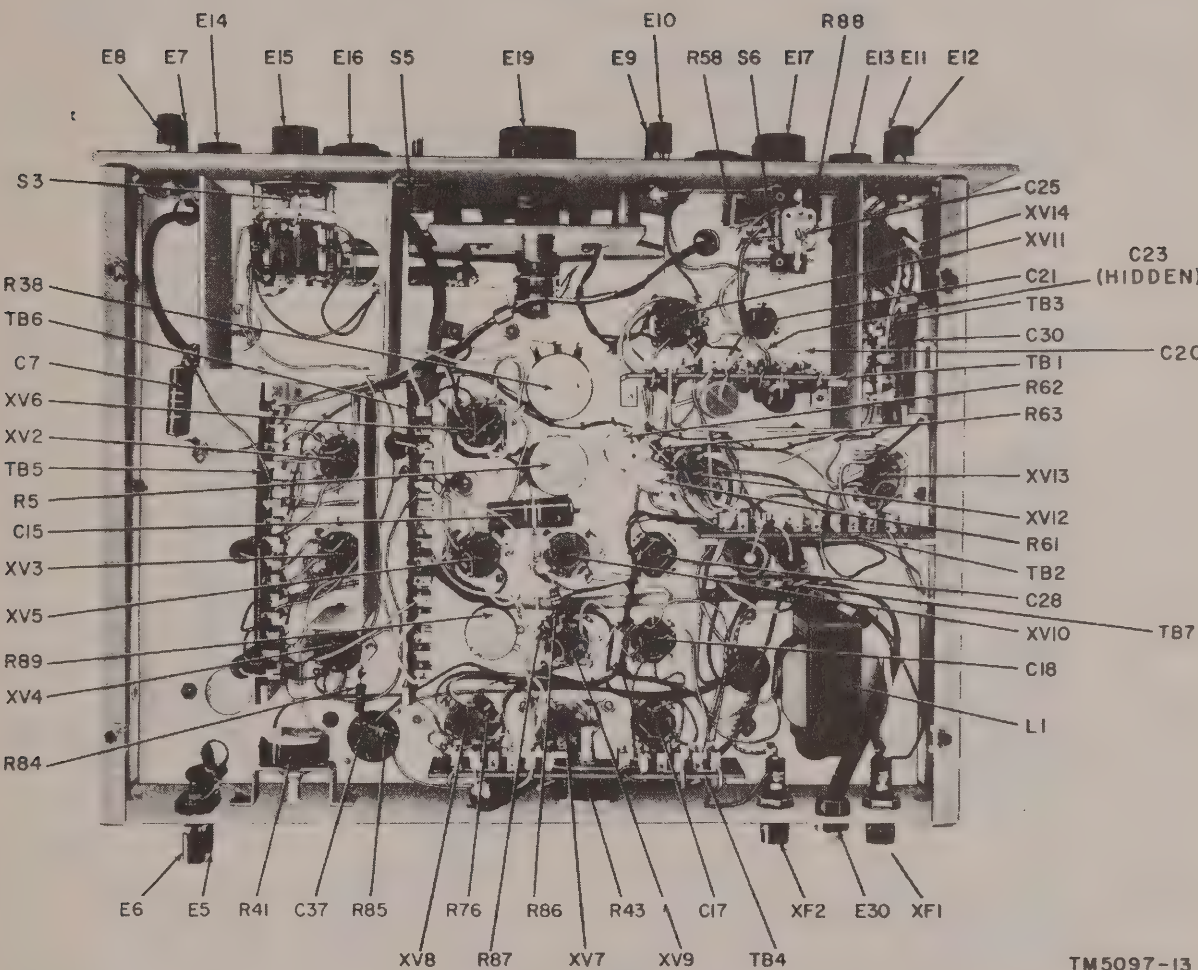


Figure 20. Bottom view of chassis.

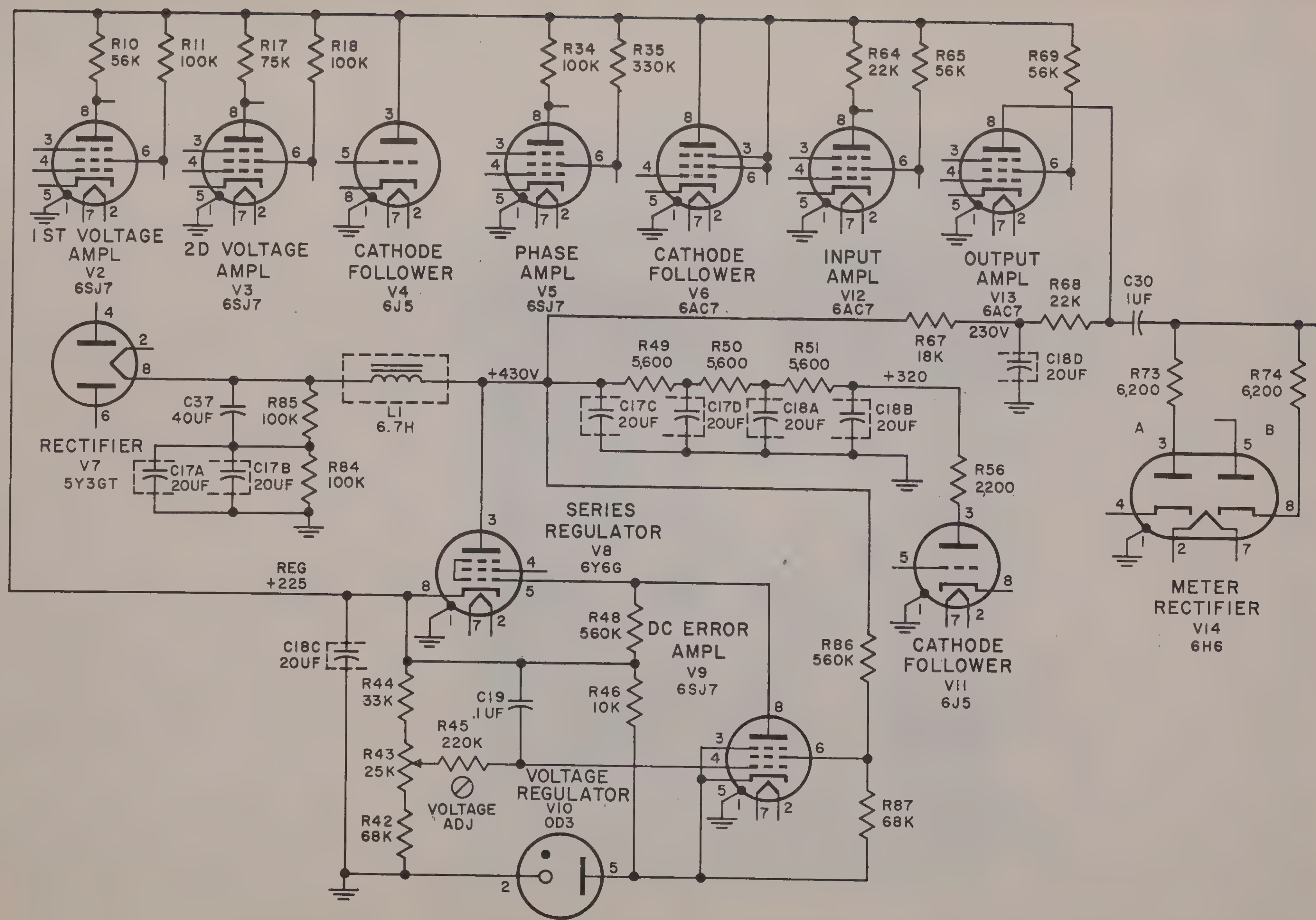
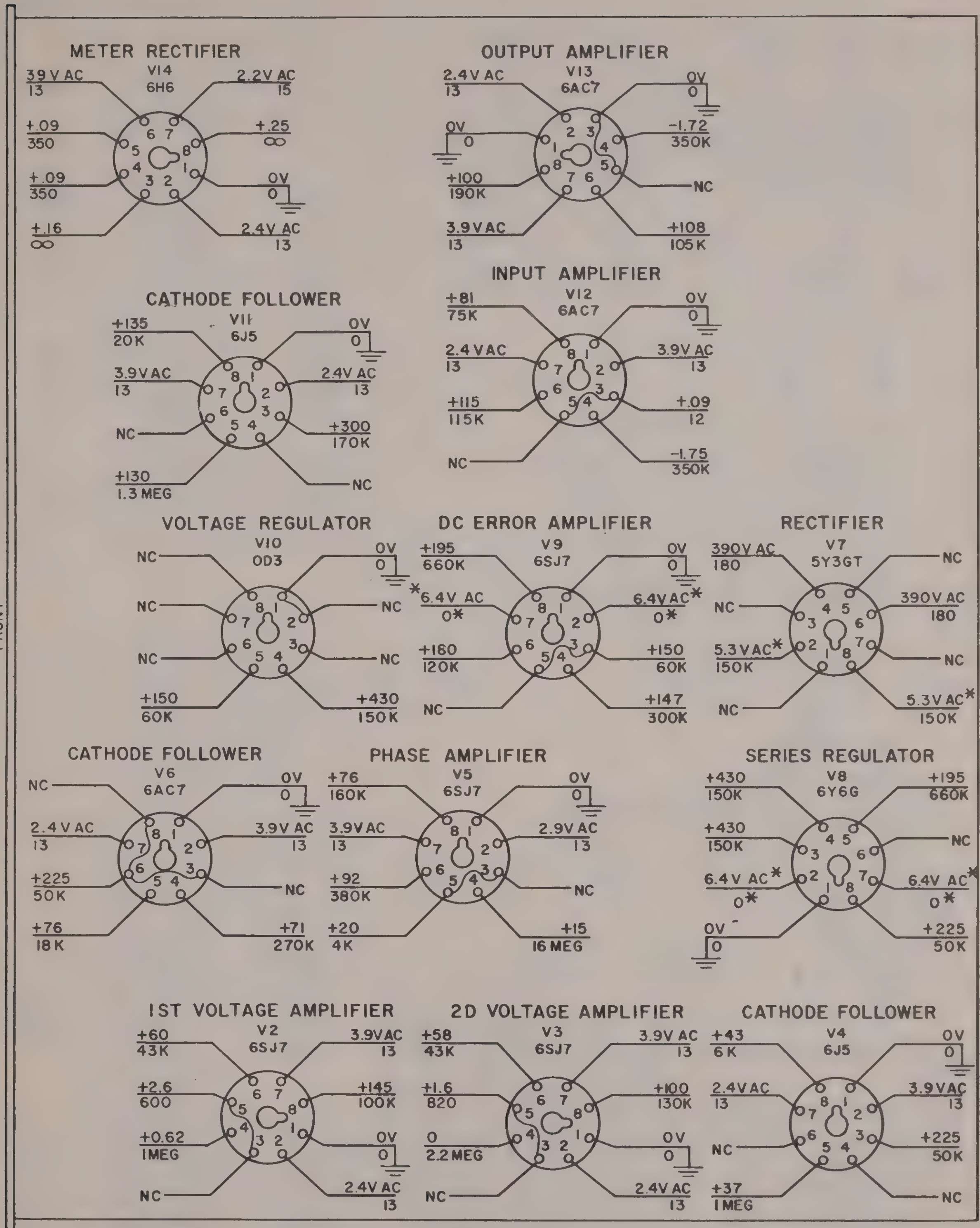


Figure 21. B+ voltage distribution.



NOTES:

1. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH A 20,000-OHMS-PER-VOLT METER. USE HIGHER METER RANGES TO PREVENT CIRCUIT LOADING.
2. * MEASURED ACROSS FILS.
3. VOLTAGE READINGS ARE ABOVE LINE, RESISTANCE READINGS BELOW LINE.
4. NC INDICATES NO CONNECTION.

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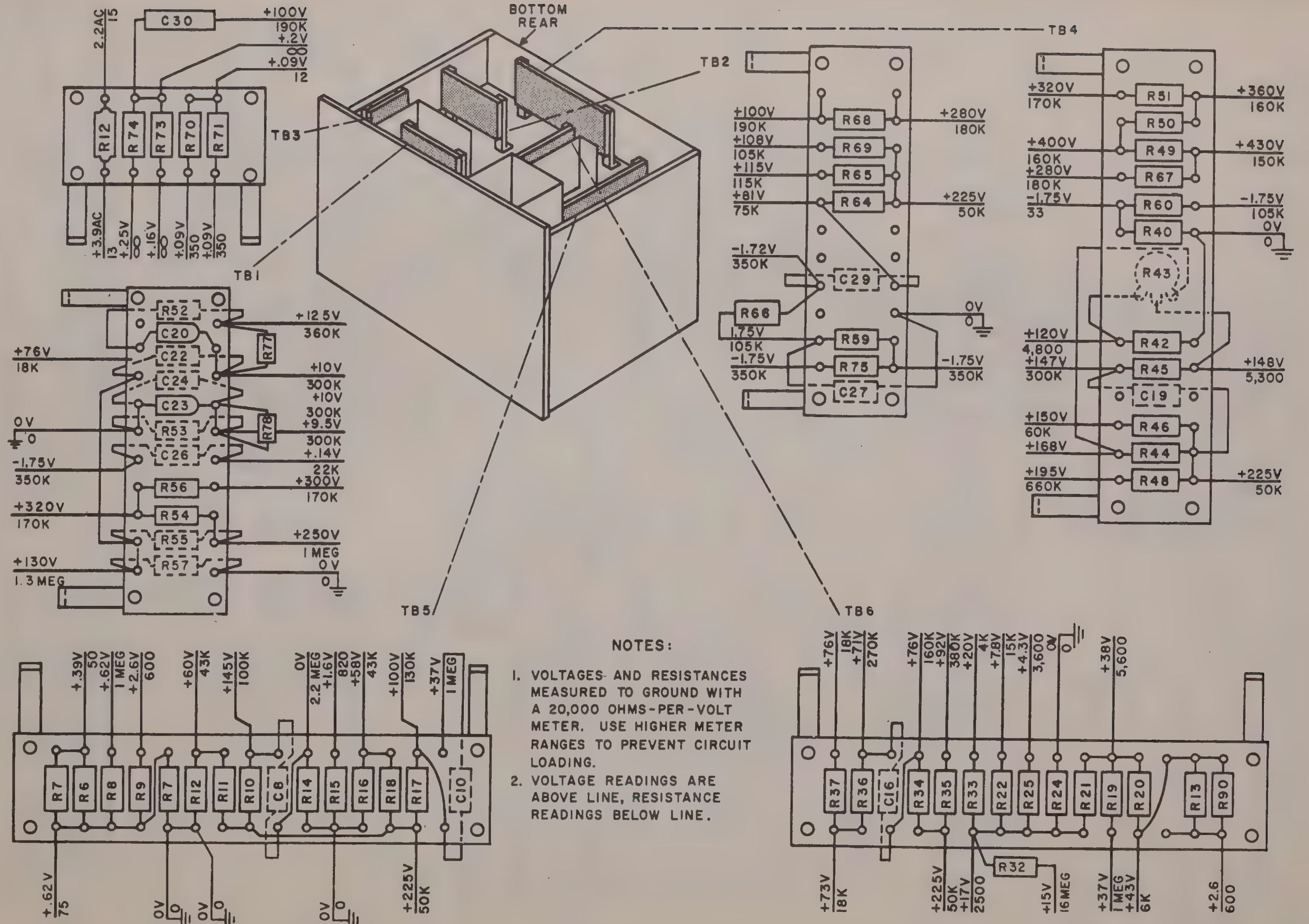
Figure 22. Tube socket voltage and resistance diagram.



NOTES:

1. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH A 20,000 OHMS-PER-VOLT METER. USE HIGHER METER RANGES TO PREVENT CIRCUIT LOADING.
2. VOLTAGE READINGS ARE ABOVE LINE, RESISTANCE READINGS BELOW LINE.

Figure 23. Terminal board voltage and resistance diagram.

54. Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the spectrum analyzer. It lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. The chart also indicates how to localize trouble quickly to an individual stage. After the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements of this stage or circuit ordinarily should be enough to isolate the defective parts.

Symptom	Probable trouble	Correction
Line cord connected to power source, and ac power switch is in ON position. The dial lamp does not light.	Defective lamp I 1. Blown fuse F1. Transformer T1 not strapped properly for the line voltage being used.	Replace lamp. Replace blown fuse with spare fuse. If fuse blows again, check size of fuse. Fuse F1 should be 1.6 amp for 115-volt operation and 0.8 amp for 230-volt operation. Check strapping of T1 (par. 13).
Function switch S4 is set at METER position. The AF oscillator adjusted to deliver several volts at 1,000 cps is connected to METER binding posts. Spectrum analyzer meter does not show response.	Fuse F2 in power supply is blown. Defective V8, V9, V10, V11, V12, V13, or V14. Switch S4 defective. Defective component in power supply or vtvm circuit.	Replace blown fuse. If fuse blows again, check C17, C37, and C18. Check V7 (par. 37). Check tubes and replace defective tube. Check contacts of the switch. Make voltage and resistance checks. Replace defective component.
Function switch S4 is set at METER position. The AF oscillator adjusted to deliver several volts at 1,000 cps is connected to METER binding posts. The oscilloscope connected to OSCILLOSCOPE binding posts shows 1,000-cps output but indication is zero or very low.	Defective C31. Defective V14. Defective meter M1.	Check C31 and replace if defective. Check V14 and replace if defective. Check M1. Replace if defective.
Function switch S4 is set at NOISE position. AF–RF selector switch S2 is set at AF position. The AF oscillator adjusted for 0.8 volt and 1,000 cps is connected to the AF INPUT binding posts. Signal INPUT control R4 is set at MAX position. Meter range switch S6 is set at 100 R.M.S. VOLTS position. Meter M1 indicates a reading significantly lower than 1 volt, or there is no meter indication.	Defective V2, V3, V4, V5, V6. Defective contacts on S2, S4, or S6 if no reading is obtained. SET LEVEL GAIN control R38 not adjusted properly. NOISE GAIN control R5 not adjusted properly. Defective component in preamplifier or bridge amplifier circuits.	Check tubes and replace defective tube (par. 37). Check switch contacts. Replace defective switch if trouble is not corrected by cleaning contacts. *Note.* Switch S6 must be replaced as an assembly including R58, R88, and C25. Refer to par. 58*e*. Refer to par. 58*e*. Make voltage and resistance checks.
Function switch S4 is set at SET LEVEL position AF–RF selector switch S2 is set at AF position. The AF oscillator adjusted for 0.8 volt and 1,000 cps is connected to the AF INPUT binding posts. Signal INPUT control R4 is set at MAX position. Meter range switch S6 is set at 10 R.M.S. VOLTS position. Meter M1 indicates a reading significantly lower than 1 volt, or there is no meter indication.	Defective contacts on S4.	Check contacts of S4. Replace if necessary.

Sympton	Probable trouble	Correction
Function switch S4 is set at DISTORTION position. AF–RF selector switch S2 is set at AF position. A signal generator adjusted for 0.1 volt is connected to the AF INPUT binding posts. Meter range switch is set at 1.0 R.M.S. VOLTS. Frequency RANGE switch S3 is set at X10. Coarse FREQUENCY knob is slowly tuned over its range but the meter cannot be set to 0.	Defective contacts on frequency RANGE switch. Variable resistor R89 not adjusted properly. Resistor R3, R27, R30, or R91 in switch assembly S3 is defective.	Check switch contacts. Replace switch if necessary (par. 58*f*). Check R3, R27, R30, and 1.R91. These resistors are selected as part of switch assembly S3. If any of these resistors is defective, replace the complete switch assembly. Check resistors R20, R21, R22, R24, and R25. Check variable resistor R23. Check C14 and variable capacitors C13 and C12.
The AF oscillator connected to the AF INPUT binding posts is adjusted to 100 cps at 0.1 volt. Frequency RANGE switch S3 is set at X1. Coarse FREQUENCY knob is slowly tuned over its range but the meter cannot be set to 0.	Defective contacts on S3. Resistor R26, R1, R2, or R31 in switch assembly S3 are defective.	Check switch contacts. Replace switch assembly if necessary. Check R1, R2, R26, and R31. If any of these resistors is defective, replace the complete switch assembly S3 (par. 58*f*).
The AF oscillator connected to the AF INPUT binding posts is adjusted to 10,000 cps at 0.1 volt. Frequency RANGE switch S3 is set at X100. Coarse FREQUENCY knob is slowly tuned over its range but the meter cannot be set to 0.	Defective contacts on S3. Resistor R28, R29, R39, or R47 is defective.	Check switch contacts. Replace switch if necessary. Check resistors. If any resistor is defective, replace the complete switch assembly S3 (par. 58*f*).

Section II. REPAIRS

55. Replacement of Parts

Note. Several parts used in the spectrum analyzer have smaller tolerances than those used in most radio equipments. Resistors R1, R2, R26, R27, R28, R29, R30, R31, R39, R47, and R91, used in the Wien bridge, are precision selected at the factory as part of switch assembly S3. If these parts require replacement, replace the complete switch assembly S3. Resistors R58 and R88 are part of switch assembly S6 and have been designed specifically for Spectrum Analyzer TS–723A/U. If either of these resistors becomes defective, it is generally advisable to replace the complete switch assembly S6. Resistors R77, R78, and R90 are close tolerance resistors and must be selected during replacement as described in paragraph 58.

a. The components of the spectrum analyzer are readily accessible and are replaced easily if found faulty. The sockets, filter capacitors, filter choke, and transformer are mounted securely to the chassis with hexagonal nuts, machine screws, or rivets.

b. To gain access to capacitor C6, switch S2, and variable resistor R4, remove the four phillips head screws that attach the front panel. Remove the four phillips head screws that attach the capacitor drive assembly to the front panel. Pull the front panel away from the capacitor drive assembly.

c. If any of the switches require replacement, carefully mark the wires connected to the switch wafers with tags to avoid misconnection when the new switch is installed. Follow this practice whenever replacement requires disconnecting numerous wires.

d. To replace the capacitor drive cables, refer to figure 24 and proceed as follows:

(1) Remove the top cover.

(2) Cut the old cables. Remove the screw that attaches rear drive cable O 20 to cone pulley O 19. Remove the screw that attaches front drive cable O 21 to cone pulley O 19. Remove the screw that attaches rear drive cable O 20 to groove pulley O 14 and the screw that attaches front drive cable O 21 to flat pulley O 13. Remove the old drive cables and discard them.

(3) Cut a piece of cable 11 inches long. Place clamp E60 over one end of the cable. Form a loop around the mounting screw in the end of the cable and insert it back through the clamp. Slide the clamp tight up against the screw with the end of the cable extending approximately one-eighth of an inch. Place the clamp on a bench and tap the clamp flat with a hammer. Use a screwdriver and hammer to crimp the clamp. Insert the free end of the cable through the hole in the large groove section of cone pulley O 19. Pull the cable through far enough to form a loop and install clamp E60 as described above.

(4) Cut a piece of cable 15 inches long. Form a loop in one end as described in (3) above. Insert the free end of the cable through the hole in the side of cone pulley O 19 associated with the small section of the pulley. Form a loop in the cable as described in (3) above.

(5) Attach drive cables O 20 and O 21 to cone pulley O 19; using the attaching screws.

(6) Loosen the setscrews in drive shaft collar O 6. Seat rear drive cable O 20 in the groove of the large section of cone pulley O 19. Bring it under the pulley and wrap it in a clockwise direction and as tight as possible around groove pulley O 14; attach it with the screw.

(7) Seat front drive cable O 21 in the groove of the small section of cone pulley O 19. Run the cable over the top of the cone pulley and wrap it one complete turn in a counterclockwise direction around idler pulley O 15. Pass the cable through the groove in the front of the bearing support on the mounting chassis and wrap it around flat pulley O 13 in a counterclockwise direction. Tighten the cable as much as is possible and attach it with the screw.

(8) Hold groove pulley O 14 with a pair of pliers; grip the edge. Rotate drive shaft collar O 6 counterclockwise until all slack is removed from both drive cables. Rotate collar O 6 an additional one-half turn counterclockwise to tighten spring A2 and tighten the two setscrews.

Note. Drive shaft collar O 6 may be turned by inserting an allen head wrench in one of the setscrews. Hold the wrench so that when the spring is tightened, the wrench can be turned with the thumb to tighten the setscrew.

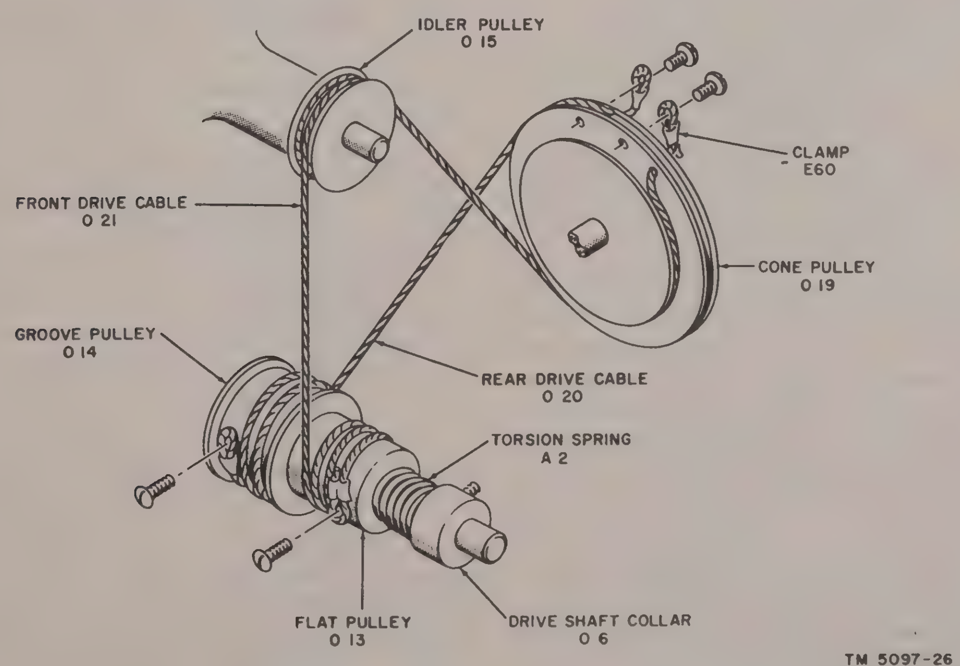


Figure 24. Replacing capacitor drive cables.

e. All knobs are held with allen head setscrews. When removing a knob, make a note of the position of the pointer and shaft and replace the knob under the same conditions.

56. Disassembly and Reassembly of Capacitor Drive Assembly

Caution: Do not disassemble the capacitor drive assembly unless absolutely necessary. It is very difficult to recalibrate. If it is necessary to repair the capacitor drive assembly, disassemble only as far as necessary to repair the defective part.

a. Disassembly. To disassemble the capacitor drive assembly (fig. 25), follow the procedure outlined in (1) through (12) below.

(1) Loosen the setscrew that attaches each FREQUENCY dial knob. Remove the two FREQUENCY dial knobs. Removing the lower FREQUENCY tuning dial knob releases disk spring A3.

(2) Remove the four No. 10–32 phillips head screws that attach the capacitor drive assembly to the front panel. Unsolder all wiring connections. Tag all wires for identification during reassembly. Lift out the capacitor drive assembly.

(3) Remove the two No. 6–32 roundhead screws, lockwashers, and nuts that attach dial window A8. Remove dial window A8.

(4) Slide dial disk O 2 off disk shaft O 3. Turn the frequency dial A5 full clockwise. Carefully make a scribe line on the face of the mounting chassis directly in line with 200 on the dial scale. Remove the four screws that attach dial shaft O 18. Remove dial shaft O 18 and dial A5. Slide out dial shaft O 3.

(5) Loosen the dial stop screw that attaches dial hub O 9. Remove dial hub O 9 and bearing washer O 60. Remove the No. 6–32 roundhead screw that attaches rear drive cable O 20 to groove pulley O 14. Remove the No. 6–32 roundhead screw that attaches front drive cable O 21 to flat pulley O 13. Loosen the two setscrews that attach spring collar O 6 and remove the spring collar and spring A2. Loosen the setscrew that attaches groove pulley O 14 and slide groove pulley O 14, flat pulley O 13, and bearing washer O 63 off drive shaft O 22. Pull flat pulley O 13 out of groove pulley O 14. Carefully remove any burrs from the shaft with No. 000 sandpaper before pulling out drive shaft O 22.

(6) Rotate capacitor C13 so that the plates are completely meshed. Note and mark the exact position of coupler O 5 on the capacitor shaft. Loosen the setscrew that attaches coupler O 5 to the shaft of capacitor C13. Remove the No. 6–32 binder head screw that attaches each mounting bracket A62. Slide capacitor C13 out of coupler O 5 and remove from mounting chassis.

(7) Remove the two No. 6–32 screws, lockwashers and nuts that attach coupler O 5 to the mounting bar of cone pulley O 19. Slide coupler O 5 from coupler shaft O 8.

(8) If cables O 20 and O 21 are to be replaced, cut the cables and remove the No. 4–40 screw that attaches each cable to cone pulley O 19. Loosen the setscrew that attaches cone pulley O 19 to coupler shaft O 8. Slide cone pulley O 19 and bearing washer O 62 from coupler shaft O 8. Loosen the two setscrews that attach coupler shaft collar O 4. Slide coupler shaft collar O 4 and bearing washer O 61 from coupler shaft O 8. Remove any burs on coupler shaft O 8 with No. 000 sandpaper before sliding the shaft out of the bearings.

(9) Lift off idler pulley O 15. Loosen the setscrew that attaches idler shaft O 7, and lift out the shaft.

(10) Remove the No. 6–32 screw that attaches each cable clamp H60 and H61. Remove cable clamps H60 and H61. Loosen the No. 6–32 screw that attaches lamp holder XI 1. Remove the lampholder.

(11) Loosen the setscrew that attaches bearing spacer E33. Press out bearing O 1, spacer E33, and bearing O 11; use a suitable press.

(12) Loosen the setscrew that attaches bearing spacer E32. Press out bearing O 11, spacer E32, and bearing O 12; use a suitable press.

b. Reassembly. To reassemble the capacitor drive assembly (fig. 25), follow the procedure given in (1) through (16) below.

(1) Press in bearing O 12; use a suitable press. Replace bearing spacer E32. Press in bearing O 11; use a suitable press. Tighten the setscrew that secures bearing spacer E32.

(2) Press in bearing O 10; use a suitable press. Replace bearing spacer E33. Press in bearing O 1; use a suitable press. Tighten the setscrew that secures bearing spacer E33.

(3) Replace idler shaft O 7 and tighten the attaching set screw. Place idler pulley O 15 on idler shaft O 7.

(4) Slide bearing washer O 62 and cone pulley O 19 over the end of coupler shaft O 8 and tighten the setscrew that attaches cone pulley O 19. Position coupler O 5 on the mounting bar of cone pulley O 19 and attach with the two screws, lockwashers, and nuts. Coat coupler shaft O 8 with Oil, Lubricating, Aircraft Instrument (OAI) and replace the shaft collar O 4 over the end of coupler shaft O 8. Hold cone pulley O 19 and coupler collar O 4 firmly against the bearing washers and tighten the two setscrews that attach coupler collar O 4.

(5) Slide capacitor C13 into coupler O 5. Rotate the plates of capacitor C13 to the fully meshed position. Aline the mark on coupler O 5 with the mark on capacitor C13 made during disassembly and tighten the setscrew. If a new coupler or capacitor is being installed, with the capacitor plates fully meshed, line up the heads of the screws used to attach coupler O 5 to coupler shaft O 8 horizontal with the top edge of capacitor C13. Attach the three mounting brackets A62 to the mounting chasis; use a No. 6–32 binder head screw and lockwasher for each bracket.

(6) Replace dial hub O 9 on drive shaft O 22 and tighten the dial stop screw securely. Place bearing washer O 60 on drive shaft O 22. Coat drive shaft O 22 with light lubricant O A1 and insert the shaft through bearings O 11 and O 12. Place bearing washer O 63, groove pulley O 14, and flat pulley O 13 on drive shaft O 22. Do not tighten the setscrews in groove pulley O 14.

(7) Seat rear drive cable O 20 in the groove of the large section of cone pulley O 19. Bring it under the pulley and wrap it around groove pulley O 14 in a clockwise direction and attach with the No. 4–40 screw.

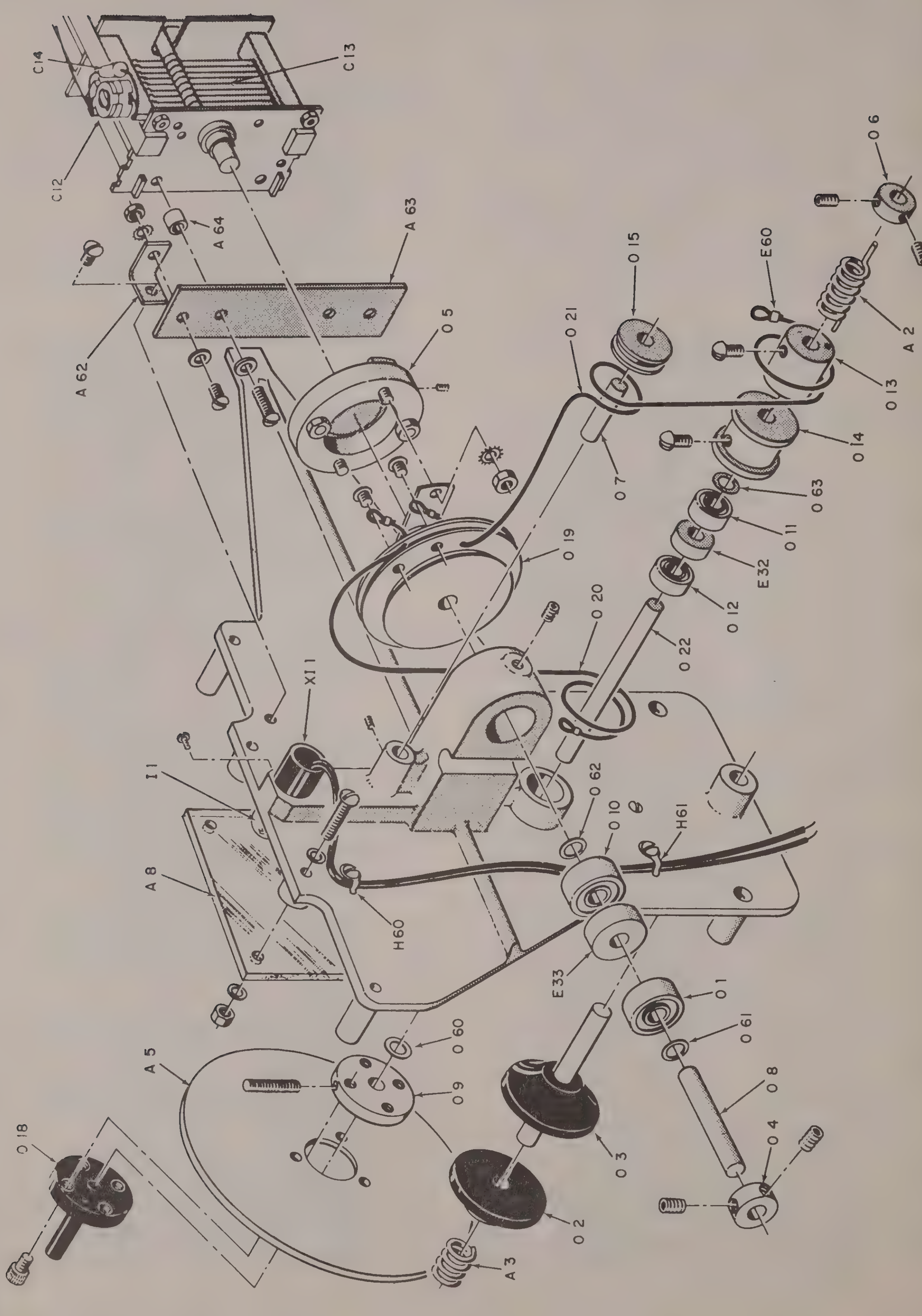
Note. If drive cables are to be replaced when groove pulley O 14 and flat pulley O 13 have not been removed from drive shaft O 22, refer to paragraph 55.

(8) Seat front drive cable O 21 in the groove of the small section of cone pulley O 19. Run the cable over the top of the cone pulley and wrap it one complete turn around idler pulley O 15 in a counterclockwise direction. Pass the cable through the groove in the front of the bearing support in the mounting chassis. Wrap the cable around flat pulley O 13 in a counterclockwise direction and attach with the No. 4–40 screw.

(9) Rotate capacitor C13 to the fully opened position. Turn drive shaft O 22 clockwise until the stop screw in hub O 9 butts against the screw extending through the front of the mounting chassis. Hold the shaft in this position and turn groove pulley O 14 until the slack is removed from rear drive cable O 20. Tighten the setscrew that attaches groove pulley O 14.

(10) Place torsion spring A2 over the end of drive shaft O 22 and seat the spring end in the hole in flat pulley O 13. Place drive shaft collar O 6 over the end of drive shaft O 22 and seat the end of the spring in the hole in the bottom of the collar.

(11) See that capacitor C13 is still in the fully opened position. Hold drive shaft O 22 in the full clockwise position and rotate flat pulley O 13 counterclockwise until the slack is removed from front drive cable O 21. Still holding shaft O 22 in the full clockwise position, rotate drive shaft collar O 6 counterclockwise until all slack is removed from both drive cables. Rotate collar O 6 an additional one-half


C14
C13
C12
A 64
A 63
A 62
O 5
O 15
O 21
E60
O 6
A 2
O 13
O 14
O 7
O 63
O 11
E 32
O 19
O 12
O 20
O 22
X1 1
I 1
A 8
O 62
O 10
H61
H60
E33
O 1
O 61
O 60
A 5
O 9
O 8
O 4
O 3
O 18
O 2
A 3

TM 5097-25

A2	Torsion spring	E33	Disk shaft bearing spacer	O 7	Dial hub	O 20	Back drive cable
A3	Disk spring	E60	Clamp	O 8	Coupler shaft	O 21	Front drive cable
A5	Frequency dial	H60	Cable clamp	O 9	Idler shaft	O 22	Drive shaft
A8	Dial window	H61	Cable clamp	O 10	Coupler shaft bearing	O 60	Bearing washer
A62	Mounting bracket	I 1	Dial lamp	O 11	Dial shaft bearing	O 61	Bearing washer
A63	Mounting board	O 1	Disk shaft bearing	O 12	Dial shaft bearing	O 62	Bearing washer
A64	Spacer	O 2	Shaft disk	O 13	Flat pulley	O 63	Bearing washer
C12	Variable capacitor	O 3	Dial shaft	O 14	Groove pulley	XI 1	Lampholder
C13	Variable capacitor	O 4	Coupler shaft collar	O 15	Idler pulley		
C14	Fixed capacitor	O 5	Coupler	O 18	Dial shaft		
E32	Dial shaft bearing spacer	O 6	Dial shaft collar	O 19	Cone pulley		

Figure 25. Capacitor drive assembly—exploded view.

turn counterclockwise to tighten torsion spring A2 and tighten the two setscrews.

Note. Drive shaft collar O 6 may be turned by inserting an allen wrench in one of the setscrews. Hold the wrench so that when the spring is tightened, the wrench can be turned with the thumb to tighten the setscrew.

(12) Replace lamp holder XI 1 and secure with the No. 6–32 screw. Run the wires down the back of the mounting chassis and attach with cable clamps H60 and H61. Coat disk shaft O 3 with oil (OAI) and replace in mounting chassis.

(13) Rotate drive shaft O 22 to the full clockwise position. Position frequency dial A5 on dial hub O 9 so that the 200 mark on the dial is exactly in line with the mark made on the face of the mounting chassis during diassembly. Position dial shaft O 18 over the four mounting holes in dial hub O 9 and attach with the four allenhead screws.

(14) Carefully clean the dial window and attach to the front of the mounting chassis with the two No. 6–32 screws, lockwashers, and nuts.

(15) Position the capacitor drive assembly inside the panel-chassis assembly and attach to the front panel. Use the four No. 8–32 phillips head screws.

(16) Place disk spring A3 over the end of disk shaft O 3 and replace the lower FREQUENCY dial knob. Replace the upper FREQUENCY dial knob on dial shaft O 18.

Note. After reassembly, the calibration of the dial must be checked as described in paragraph 59.

Section III. CALIBRATION AND ALINEMENT

57. Equipment Required for Calibration and Alinement

a. Test Equipment. The equipment required for calibration and alinement uses the same test equipment as required for troubleshooting (par. 51) in addition to the following:

Test equipment	TM No.	Common name
Electronic Multimeter ME–30/U*		Vtvm
Signal Generator SG–71/FCÇ	TM 11–5088	Signal generator
Frequency Meter FR–67/U	TM 11–2698	Frequency counter
Variable Transformer CN–16/U		Variable transformer
Decade Resistor TS-679/U		Decade resistor box

*If this vtvm is not available, either Electronic Multimeter ME–6A/U or Electronic Multimeter TS-505/U (TM 11–5511) can be used.

b. Test Requirements. All tests should be conducted under the following conditions:

(1) Tests should be conducted at normal room temperature.

(2) The equipment should be on for a warmup period of 30 minutes before tests are begun.

(3) The line input voltage should be maintained at 115 volts except as otherwise noted.

58. Calibration of Spectrum Analyzer

To calibrate and aline the spectrum analyzer properly, follow the procedures in the sequence given below.

a. Regulated B+ Voltage. The regulated B+ voltage (+225 volts) provides a part of the stability of the spectrum analyzer; therefore, it is important that this voltage be set correctly before further adjustments are made.

(1) Make the following connections:

(*a*) Connect the spectrum analyzer power cord to the variable transformer output terminals.

(*b*) Connect the multimeter (in ac position) to measure the output of the variable transformer.

(*c*) Connect the vtvm (in dc position) between ground and pin 8 of V8.

(*d*) Connect the variable transformer to the power source.

(2) Adjust the variable transformer output to 115 volts.
(3) Turn on the spectrum analyzer and adjust control R43 so that the vtvm indicates +225 volts.
(4) Adjust the variable transformer so that the multimeter indicates between 102 and 128 volts. The vtvm should indicate between 223 and 227 volts.

b. Zero Setting Meter M1. Zero set the meter before proceeding with the calibration procedures given in (1) through (9) below.

(1) Turn on the spectrum analyzer.
(2) Turn the meter range switch to 300 R.M.S. VOLTS.
(3) Turn the function switch to METER.
(4) Allow the equipment to warm up. If the meter pointer rests at 0 on the top scale, turn the meter range switch to 0.03 R.M.S. VOLTS. Unscrew the top METER binding post and touch the metal part of the binding post with the finger. The meter pointer should deflect full clockwise and pin against the right stop. Remove the finger and note that the meter pointer returns to 0. This will indicate that the vtvm circuit and the power supply are operating properly.
(5) If the meter pointer does not rest at exactly 0 with the meter range switch set at 300 R.M.S. VOLTS ((4) above), record the meter indication. Turn the zero adjust screw until the meter pointer rests at exactly 0 on the top meter scale. Turn the spectrum analyzer off. The meter pointer should drop below the 0 calibration mark. This drop should not exceed one-half a division on the top meter scale. If the drop is greater than this, turn the spectrum analyzer on and adjust the screwdriver adjustable control on the face of the meter to obtain the same meter indication recorded in (4) above.
(6) With the spectrum analyzer turned on, remove V13. If the meter pointer does not return to 0, the thermal emission from V14 is too high. Replace V14. If replacing V14 does not bring the meter pointer back to 0, replace original V14 and check C18D.
(7) If, when V13 is removed, the meter pointer drops to 0, replace V13 and place a wire jumper across the METER binding posts. If the meter pointer drops to 0, the source of the meter indication is external RF fields. If the meter pointer does not drop to 0 when the METER binding posts are shorted, remove V12. If the meter pointer does not drop to 0, V13 is defective. Replace V13. If replacing V13 does not bring the meter pointer back to 0, replace original V13 and check C27.
(8) If the meter pointer does drop to 0 when V12 is removed, replace V12 and remove V11. If the meter pointer does not drop to 0, V12 is defective. Replace V12.
(9) If the meter pointer does drop to 0 when V11 is removed, replace V11. If replacing V11 does not bring the meter pointer back to 0, return original V11 and check V10.

c. Adjusting HUM BAL Control. Adjust for hum balance as follows:

(1) Zero set the meter as described in *b* above.
(2) Set the function switch to DISTORTION.
(3) Connect a 10-megohm resistor across the AF INPUT binding posts. Cover the resistor and AF INPUT binding posts with lead foil. The lead foil must be grounded and completely insulated from the resistor and binding posts.
(4) Set the frequency RANGE switch to X1.
(5) Set the signal INPUT control to MIN.
(6) Set the meter range switch to 0.03 R.M.S. VOLTS.
(7) If the meter pointer rests at 0, or indicates at not more than one division, adjustment for hum balance is not necessary.

Note. The maximum allowable reading is 0.0007 R.M.S. VOLTS.

(8) If the meter pointer does not rest at 0, turn the FREQUENCY tuning dial to 60. If the combination of adjusting the FREQUENCY tuning knobs and the BALANCE control at near 60 cps results in a zero-meter indication, 60-cycle

hum is present in the circuit. Turn the function switch to SET LEVEL and adjust HUM BAL control R41, located on the rear panel, for a zero-meter indication. If turning the FREQUENCY tuning dial to 60 cps does not result in a zero-meter indication, the meter is indicating noise. Check V2, V3, V4, V5, and V6.

(9) If a zero-meter indication cannot be obtained by adjusting R41, replace V2 and readjust R41 for a zero-meter indication.

(10) If the meter cannot be zero set by replacing V2, replace original V2 to its socket. Repeat this test for tubes V3, V4, V5, and V6.

d. Calibrating Vtvm Section. Calibrate the vtvm section as follows:

(1) Connect the signal generator and the vtvm to the METER binding posts. Adjust the signal generator for 1,000 cps at exactly 1 volt.

(2) Turn on the spectrum analyzer and allow it to warm up for 15 minutes.

(3) Set the function switch to METER.

(4) Set the meter range switch to 1.0 R.M.S. VOLTS.

(5) Adjust variable resistor R62 (VM GAIN) for a meter reading of 1.0 R.M.S. VOLTS on the top meter scale.

(6) Set the meter range switch to 3.0 R.M.S. VOLTS. Record the reading obtained on the meter.

(7) Adjust the voltage output of the signal generator to produce a reading of 0.08 volt on the meter in the spectrum analyzer. Record the reading on the vtvm.

(8) Adjust the signal generator for 10,000 cps at the same voltage output recorded on the vtvm ((7) above). Set the meter range switch to 0.10 R.M.S. VOLTS. The meter in the spectrum analyzer should indicate 0.08 ±3 percent R.M.S. VOLTS. If this reading is not obtaitned, adjust trimmer C25 until the meter indicates 0.08 ±3 percent R.M.S. VOLTS.

(9) Adjust the signal generator for 100,000 cps at the same voltage output recorded on the vtvm ((7) above). The reading on the meter in the spectrum analyzer should be 0.08 ±3 percent R.M.S. VOLTS. If this reading is not obtained, adjust C25 until the meter indicates 0.08 ±3 percent R.M.S. VOLTS.

(10) Repeat the adjustments described in (8) and (9) above until the 0.08 ±3 R.M.S. VOLTS reading is obtained for both 10,000 and 100,000 cps without requiring further readjustment.

(11) Set the meter range switch to 100 R.M.S. VOLTS.

(12) Adjust the signal generator for 1,000 cps. Adjust the voltage output of the signal generator to produce a reading of 80 R.M.S. VOLTS on the meter in the spectrum analyzer. Record the reading on the vtvm.

(13) Adjust the signal generator for 10,000 cps at the same voltage output recorded in (12) above. The meter in the spectrum analyzer should indicate 80 ±3 percent R.M.S. VOLTS. If this reading is not obtained, adjust trimmer C20 until the meter indicates 80 ±3 percent R.M.S. VOLTS.

(14) Adjust the signal generator for 100,000 cps at the same voltage output recorded in (12) above. The meter in the spectrum analyzer should indicate 80 ±3 percent R.M.S. VOLTS. If this reading is not obtained, adjust C20 until the meter indicates 80 ±3 percent R.M.S. VOLTS.

(15) Repeat the adjustments described in (13) and (14) above until the reading of 80 ±3 percent R.M.S. VOLTS is obtained for both 10,000 cps and 100,000 cps without further readjustment. If the proper tolerance cannot be obtained for both frequencies, first measure R77 and replace it with a lower value resistor selected from the list shown below. Repeat (13) and (14) above. If the proper tolerance still cannot be obtained, replace R77 with a higher value resistor than the original one and repeat (13) and (14) above until the proper tolerances are obtained.

Resistor	Values used in individual sets (K)
R77	82
	91
	100
	110
	120
R78	10
	11
	12
R90	82
	100
	120
	150
	180
	220

Note. An alternate procedure for finding the value of R77 when the decade resistor box is available is to disconnect and measure R77, set the decade resistor box for this value and substitute it in place of R77, then follow the procedure given here.

(16) Set the meter range switch to 300 R.M.S. VOLTS.

(17) Adjust the signal generator for 1,000 cps. Adjust the voltage output of the signal generator to produce a reading of 250 R.M.S. VOLTS on the meter in the spectrum analyzer. Record the reading on the vtvm.

(18) Adjust the signal generator for 10,000 cps at the same voltage output recorded in (17) above. The meter in the spectrum analyzer should indicate 200 ±3 percent R.M.S. VOLTS. If this reading is not obtained, adjust trimmer C23 until the meter indicates 200 ±3 percent R.M.S. VOLTS.

(19) Adjust the signal generator for 100,000 cps at the same voltage output recorded in (17) above. The meter in the spectrum analyzer should indicate 250 ±3 percent R.M.S. VOLTS. If this reading is not obtained, adjust C23 until the meter indicates 200 ±3 percent R.M.S. VOLTS.

(20) Repeat the adjustments described in (18) and (19) above until the reading of 200 ±3 percent R.M.S. VOLTS is obtained for both 10,000 cps and 100,000 cps without further readjustment. If the proper tolerance cannot be obtained for both frequencies, follow the procedure given in (15) above to find the proper value for R78 but refer to (18) and (19) above in place of (13) and (14) above.

e. Adjustment of Preamplifier-Bridge Amplifier Gain.

(1) Adjust the signal generator for 1,000 cps and connect it to the AF INPUT terminal. Connect a vtvm across the AF INPUT terminal and adjust the output of the signal generator for a 0-db indication on the vtvm.

(2) Set the function switch to SET LEVEL.

(3) Remove V6 from its socket.

(4) Set the signal INPUT control to MAX.

(5) Remove the vtvm from the AF INPUT binding posts without disturbing the signal generator connections. Connect the vtvm to pin 8 of V4. The vtvm should indicate between −2 and −1 db. This indicates a total gain of 18 to 19 db for the amplifier. If the proper reading is not obtained, replace R90 to compensate for the error. The selective values of R90 are listed in *d*(15) above. Follow the procedure given in this step for replacing R90 with resistors of different values until the proper vtvm reading is obtained. If the proper reading cannot be obtained, replace tubes V2, V3, and V4 and repeat the selective procedure for R90.

(6) Set the function switch to METER.

(7) Set the meter range switch to −20 DB.

(8) Connect the signal generator to the METER binding posts and adjust the signal generator for 100 cps. Adjust the output of the signal generator so that a reading of exactly −20 db is obtained on the meter in the spectrum analyzer. *For the following tests, do not disturb the level of the 100-cps signal.*

(9) Set the function switch to SET LEVEL.

(10) Set the meter range switch to 0 DB.

(11) Set the AF–RF selector switch to AF.

(12) Set the signal INPUT control to MAX.

(13) Move the input of the signal generator from the METER binding posts to the AF INPUT binding posts.

(14) Adjust SET LEVEL GAIN control R38, located on top of the chassis, to produce a meter reading of exactly 0 db.

(15) Set the function switch to NOISE.

(16) Set the meter range switch to +20 DB.

(17) Adjust NOISE GAIN control R5 to produce a meter reading of exactly +20 db.

f. Calibrating Wien Bridge Circuit. For adjustments to the bridge circuit, proceed as follows:

(1) Set BALANCE control R23 to its midrange position.

(2) Set the frequency RANGE switch to X10.

(3) Set the AF–RF selector switch to AF.

(4) Set the signal INPUT control to MAX.

(5) Set meter range switch to +20 DB.

(6) Set the function switch to DISTORTION. See that the FREQUENCY tuning dial is not set near 100.

(7) Connect the signal generator to the AF INPUT binding posts. Adjust the signal generator for 1,000 cps and increase its amplitude until the meter on the spectrum analyzer indicates exactly +20 db.

(8) Turn the FREQUENCY tuning dial at exactly 100. This is equivalent to 1,000 cps.

(9) The meter pointer should deflect to 0 on the top scale. Decrease the setting of the meter range switch one step at a time. The meter should return to 0 on the top scale with each setting of the switch. In the −30 DB position of the switch, the meter pointer should be to the left of −10 DECIBELS (equivalent to 60 db down from the original reference setting of +20 DB). *If the proper meter indications are observed, do not make any adjustments to the bridge circuit.* If the proper meter indications are not observed, proceed with (10) below.

(10) Set the meter range switch in the position where the best null was obtained ((9) above). Minutely adjust trimmer C12 and balance setting control R89 until the proper meter deflection is obtained. Work back and forth between those two controls as required. Do not change the setting of the FREQUENCY tuning dial.

(11) If the proper meter deflection cannot be obtained ((10) above), replace switch assembly S3 and repeat (10).

Note. **The 12 resistors attached to switch assembly S3 are factory selected and cannot be replaced individually.**

g. Adjusting FREQUENCY Tuning Dial. When the capacitor drive assembly has been disassembled, or if the screws that retain the dial shaft have become loosened through vibration, the FREQUENCY tuning dial may shift out of position. To return the dial to its proper position, proceed as follows:

(1) Set the BALANCE control to its midrange position.

(2) Set the frequency RANGE switch to X10.

(3) Set the AF–RF selector switch to AF.

(4) Set the meter range switch to +20 DB.

(5) Set the function switch to DISTORTION.

(6) Adjust the signal generator to 1,000 cps. Check the output of the signal generator with the frequency counter.

(7) Adjust the FREQUENCY tuning control knobs to obtain a meter indication of 0 on the top meter scale. Decrease the setting of the meter range switch to −30 DB. Adjust the FREQUENCY tuning control knobs to obtain the maximum left-hand meter deflection of the meter pointer. The meter pointer must deflect to the left of −10 DECIBELS (equivalent to 60-db down from the original +20 DB reference setting).

(8) Hold the capacitor drive shaft securely in this position with a pair of pliers gripping the drive shaft collar on the inside end of the shaft. Remove the upper FREQUENCY tuning control knobs by loosening the two setscrews. Slip the FREQUENCY tuning dial around its hub until the 100 mark lines up exactly with the line down the center of the FREQUENCY tuning dial window. Tighten the four allen head screws in the collar of the frequency dial shaft by inserting an allen head wrench through the shaft hole in the front of the front panel. Replace the upper FREQUENCY tuning control knob.

h. Recalibrating FREQUENCY Tuning Dial. When variable capacitor C13 is replaced, it may be necessary to recalibrate the FREQUENCY tuning dial. The old FREQUENCY tuning dial may be reused by turning it over, or a new blank dial may be requisitioned. Recalibrate the FREQUENCY tuning dial as follows:

(1) Replace the old FREQUENCY tuning dial with a new blank dial or turn the old dial over (par. 56*a*). Remove the FREQUENCY tuning dial window. Using the FREQUENCY tuning dial window as a template, cut a piece of thin metal identical with that of the frequency dial window. Scribe the metal with a centerline equal to the centerline on the frequency dial window. Measure three-eighths of an inch from the edge of the plate where the mounting holes are located and scribe a line at right angles to the centerline. Cut along this line to the centerline. Cut down the centerline to the right-angle line and remove the rectangular piece of metal. Attach the notched metal plate to the face of the mounting chassis in place of the FREQUENCY tuning dial window. Attach the capacitor drive assembly to the front panel (par. 56*b*). Replace the two FREQUENCY tuning control knobs.

(2) Set the BALANCE control to its mid-range position.

(3) Set the FREQUENCY RANGE switch to X10.

(4) Set the AF–RF selector switch to the AF.

(5) Set the meter range switch to +20 DB.

(6) Set the function switch to DISTORTION.

(7) Adjust the signal generator at 1,000 cps. Check the output of the signal generator with the frequency counter. Connect the signal generator to the AF INPUT binding posts. Adjust the output of the signal generator for a reading of exactly +20 db on the meter in the spectrum analyzer.

(8) Adjust the FREQUENCY tuning control knobs to obtain a meter indication of 0 on the top meter scale. Decrease the setting of the meter range switch to −30 DB. Adjust the FREQUENCY tuning and the BALANCE control knobs to obtain the maximum left-hand meter deflection of the meter pointer. The meter pointer must deflect left of −10 DECIBELS (equivalent to 60 db down from the original +20 DB reference setting).

(9) When the best possible meter null has been obtained, scribe a mark on the face of the FREQUENCY tuning dial along the edge of the notched metal plate. Write 100 above this scribed line.

(10) Adjust the signal generator for each of the following frequencies, each time adjusting for a meter null as described in (8) above and scribing the dial as described in (9) above—

190, 195, 200, 205, 210, 215, 220, 225, 230, 235, 240, 245, 250, 255, 260, 265, 270, 275, 280, 285, 290, 295, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 450, 460, 470, 480, 490, 500, 520, 540, 560, 580, 600, 620, 640, 660, 680, 700, 720, 740, 760, 800, 820, 840, 860, 880, 900, 920, 940, 960, 980, 1000, 1100, 1150, 1200, 1250, 1300, 1350, 1400, 1450, 1500, 1550, 1600, 1650, 1700, 1750, 1800, 1850, 1900, 1950, 2000, 2050, and 2100.

(11) Set the frequency RANGE switch to X1.

(12) Repeat the procedure given in (8), (9), and (10) above starting with the signal generator set at 20 cps. The mark on the dial made for 200 cps should be in line with the edge of the notched metal plate. Set the signal generator at 100 cps and check to see that the scribed line made at 1,000 cps lines up with the notched metal plate. Set the signal generator for 200 cps and see that the scribed line made at 1,000 cps lines up with the notched metal plate. Set the signal generator for 200 cps and see that the scribed line made at 2,000 cps lines up with the notched metal plate.

(13) Set the frequency RANGE switch to X100.

(14) Repeat step (12) with the signal generator set at 2,000, 10,000, and 20,000 cps in turn.

Note. If there is more than 1/64-inch difference in the position of the scribe lines for the three settings of the RANGE switch, calibrate the bridge circuit as described in *f* above and repeat (2) through (14).

(15) Remove the FREQUENCY tuning dial and the notched metal plate from the capacitor drive mechanism and engrave the markings using the old dial as a pattern. Engrave numbers as follows:

20 for 20, 200, or 2,000 cps
22 for 22, 220, or 2,200 cps

25 for 25, 250, or 2,500 cps
30 for 30, 300, or 3,000 cps
35 for 35, 350, or 3,500 cps
40 for 40, 400, or 4,000 cps
50 for 50, 500, or 5,000 cps
60 for 60, 600, or 6,000 cps
70 for 70, 700, or 7,000 cps
80 for 80, 800, or 8,000 cps
100 for 100, 1,000, or 10,000 cps
130 for 130, 1,300, or 13,000 cps
160 for 160, 1,600, or 16,000 cps
200 for 200, 2,000, or 20,000 cps

(16) After engraving, black anodize or paint the dial with black enamel and fill the letters with white lead.

(17) Reinstall the completed FREQUENCY tuning dial and adjust as described in *g* above.

Section IV. FINAL TESTING

59. General

This section is a guide to be used in determining the quality of a repaired Spectrum Analyzer TS–723A/U. The minimum test requirements outlined in paragraphs 60 and 61 may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

60. Test Equipment Required for Final Testing

The test equipment required for calibration and alinement is also used for final testing.

61. Vtvm Circuit

a. Adjust the signal generator for 1,000 cps and connect it to the METER binding posts. Adjust the output of the signal generator for exactly 1 volt. Set the function switch in the METER position. Set the meter range switch to 3.0 R.M.S. VOLTS. The meter in the spectrum analyzer should indicate 1 ±3 percent R.M.S. VOLTS.

b. Adjust the signal generator for 10,000 cps and adjust the output for exactly 0.08 volt. Set the meter range switch to 0.10 R.M.S. VOLTS. The meter in the spectrum analyzer should indicate 0.08 ±3 percent R.M.S. VOLTS.

c. Adjust the signal generator for 100,000 cps and adjust the output for exactly 0.08 volt. Set the meter range switch to 0.10 R.M.S. VOLTS. The meter in the spectrum analyzer should indicate 0.08 ±3 percent R.M.S. VOLTS.

d. Adjust the signal generator for 10,000 cps and adjust the output for exactly 200 volts. Set the meter range switch to 300 R.M.S. VOLTS. The meter on the spectrum analyzer should indicate 200 ±3 percent R.M.S. VOLTS.

62. Frequency Selective Amplifier Circuit

a. Adjust the signal generator at 1,000 cps at exactly −20 db and connect it to the AF INPUT binding posts. Set the function switch to NOISE, the meter range switch to +20 DB, the signal INPUT control to MAX, and the frequency RANGE switch to X1. The meter on the spectrum analyzer should indicate a +20 DB gain (meter pointer at 0 DECIBELS).

b. Leave the signal generator connected and adjusted as described in *a* above. Set the function switch to SET LEVEL, and meter range switch to 0 DB. The meter should indicate 0 DB.

c. Leave the signal generator connected and adjusted as described in *a* above. Set the function switch to DISTORTION. Turn the FREQUENCY tuning dial to 100 (1,000 cps). Set the meter range switch to −30 DB. The meter should indicate a reading of −40 db or less (equivalent to 60 db down from −20 db reference from the signal generator).

d. Adjust the signal generator at 10.000 cps at exactly −20 db and repeat the tests given in *a*, *b*, and *c* above.

63. Check of Second Harmonic Attenuation

a. Connect the signal generator and the vtvm to the AF INPUT binding posts.

b. Turn the function switch to SET LEVEL.

c. Adjust the signal generator to 200 cps and adjust the spectrum analyzer to 100 cps.

d. Adjust the signal INPUT control so that the meter indicates 0 DECIBELS when the meter range switch is set at 10 DB.

e. Turn the function switch to DISTORTION; keep the signal generator output constant.

f. The meter reading should not drop more than 1.5 db.

g. Repeat this test for 1,500 cps on the spectrum analyzer and 3,000 cps on the signal generator.

h. Repeat the above test for frequencies of 5 and 20 kc on the spectrum analyzer and for frequencies of 10 and 40 kc on the signal generator. In these two tests, the meter reading should not drop more than 3 db.

CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

64. Disassembly

The following instructions are recommended as a guide for preparing Spectrum Analyzer TS–723A/U for transportation and storage:

a. Remove any leads connected to the binding posts.

b. Disconnect the power cord from the power outlet.

c. Remove the spectrum analyzer from the relay rack.

d. Roll up the power cord and tape it with a piece of friction tape.

65. Material Requirements (Estimated)

a. The following materials are required for packaging the spectrum analyzer for shipment:

Material	Quantity
Corrugated single-face, flexible paper	16 sq ft
Waterproof, barrier material	16 sq ft
Excelsior, medium 2-inch thickness all-around.	5 lb
Water-resistant, gummed, kraft type	6 ft
Flat steel strapping	12 ft
Wooden shipping boxes	1

b. Data for the wooden crate are given in paragraph 9.

66. Field Repackaging

Whenever possible, use the procedures outlined below to repackage the equipment. The information concerning the original packaging (par. 9 and fig. 2) may also be helpful.

a. Spectrum analyzer. Secure all covers and fastenings; cushion the control panel with flexible single-face corrugated paper. Cushion the spectrum analyzer on all surfaces with pads fabricated of flexible single-face corrugated paper. Place the cushioned unit within a wrap of flexible single-face corrugated paper. Secure the wrap with gummed kraft tape.

b. Spare Parts. Package spare parts individually by wrapping them with cellulose wadding and flexible single-face corrugated paper. Secure the wrap with gummed kraft tape. Consolidate packaged spare parts within a wrap of flexible single-face corrugated paper. Secure the wrap with gummed kraft tape.

67. Field Repacking and Strapping

a. Construction of Boxes. Construct the wooden box having the dimensions listed in paragraph 65. Each end of the box has two exterior cleats running across the grain (fig. 2). The cleats extend to one-eighth of an inch of the outside edges of the top and bottom; the sides extend over the cleats. Line the box with a waterproof-barrier case liner. Cut the waterproof-barrier material so that its length is 7 feet long.

b. Packing. Pack the consolidated package and the spectrum analyzer into the nailed wooden box. Fill the voids in the box with pads of flexible corrugated paper. Use metal strapping around the box as it is intended for intertheater shipment.

68. General

The demolition procedures outlined in paragraph 69 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

69. Methods of Destruction

a. Smash. Smash the controls, tubes, switches, capacitors, transformer, and meter; use sledges, axes, handaxes, pickaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut the output of the power cord; use axes, handaxes, or machetes.

c. Burn. Burn cords and technical manuals; use gasoline, kerosene, oil, flamethrowers or incendiary grenades.

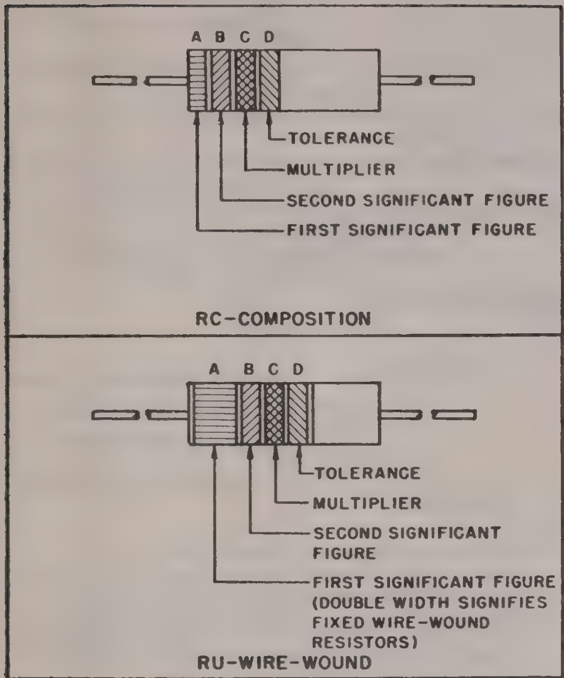
d. Bend. Bend panel and chassis.

e. Explode. If explosives are necessary, use firearms, grenades, or TNT.

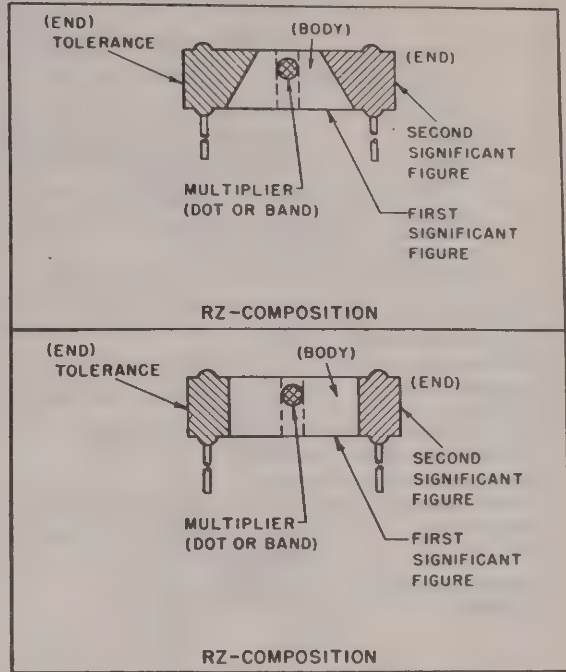
f. Dispose. Bury or scatter the destroyed parts in slit trenches, foxholes, or throw them into streams.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)



RADIAL-LEAD RESISTORS (UNINSULATED)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

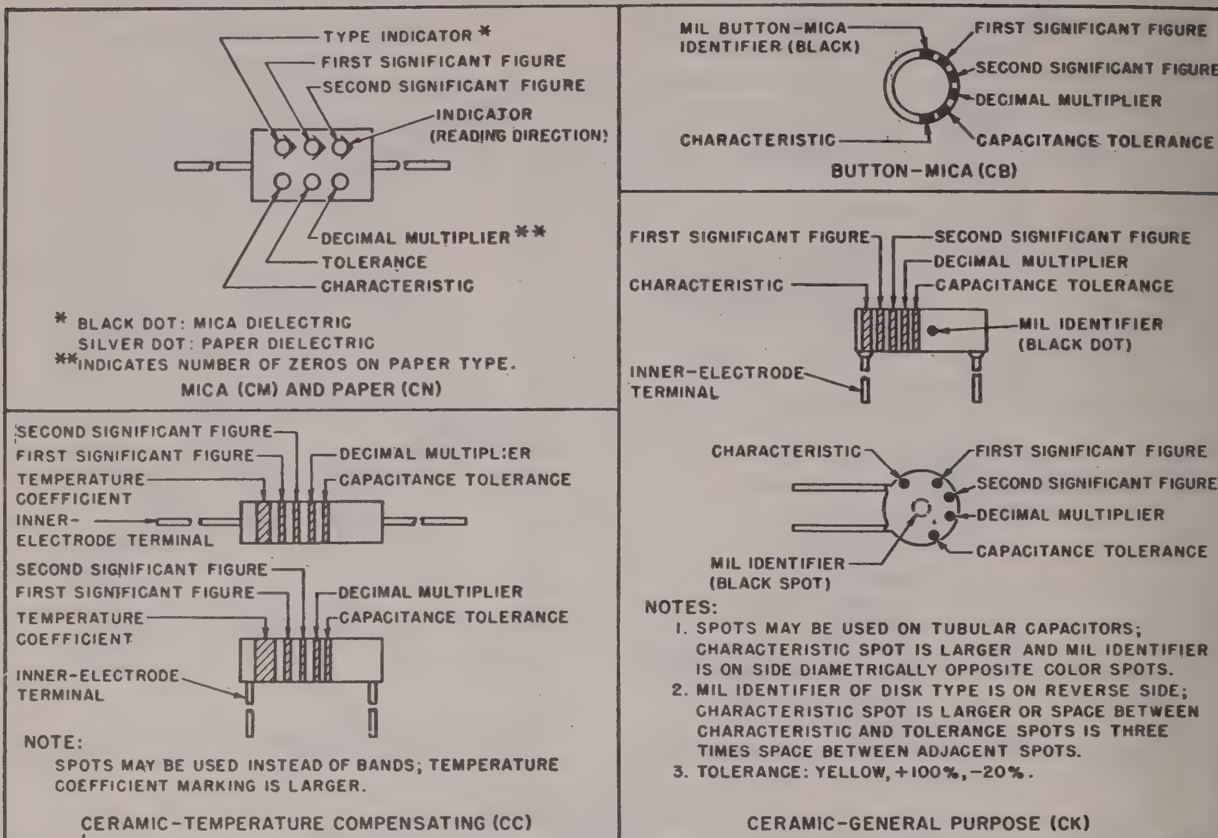
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-R1

Figure 26. Resistor color code.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE[2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC OVER 10UUF	CC 10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500)[3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

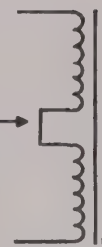
1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-C1

Figure 27. Capacitor color code.

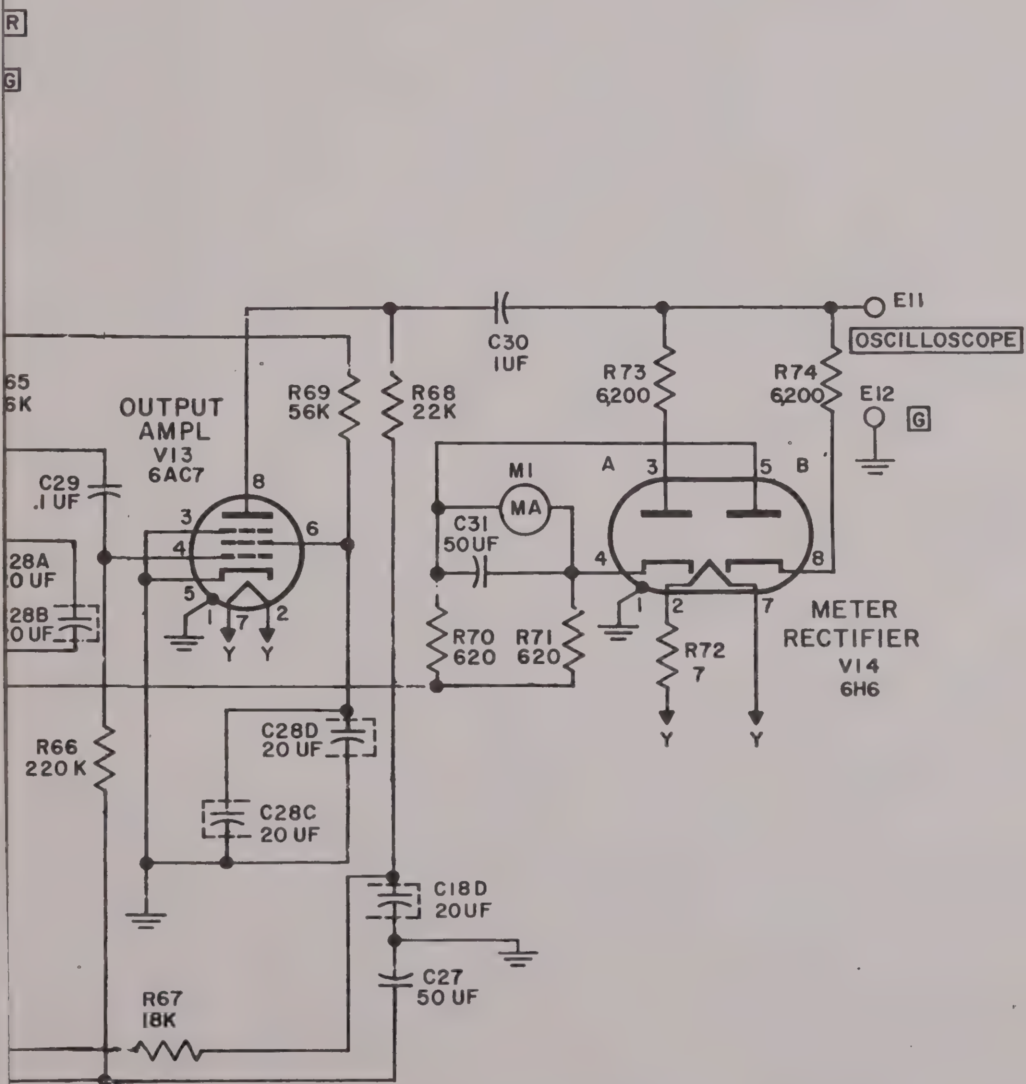
NOTES:

1. UNLESS OTHERWISE INDICATED; RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. INDICATES FACTORY SELECTED. EXACT VALUES ARE DETERMINED BY ALIGNMENT REQUIREMENTS.
3. INDICATES EQUIPMENT MARKING.
4. TRANSFORMER T1 SHOWN STRAPPED FOR 115-VOLT OPERATION. FOR 230-VOLT OPERATION, STRAP THE PRIMARY WINDING OF T1 AS FOLLOWS:

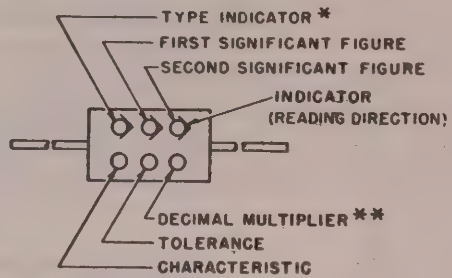


5. SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB.

6. FUSE F1 IS .8 AMP FOR 230V OPN.

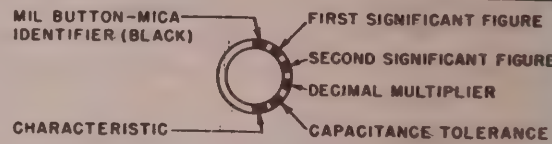


CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)

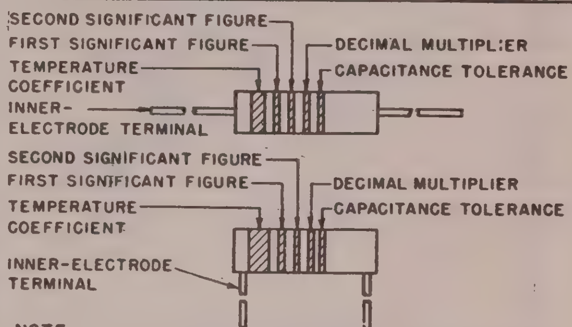


* BLACK DOT: MICA DIELECTRIC
SILVER DOT: PAPER DIELECTRIC
**INDICATES NUMBER OF ZEROS ON PAPER TYPE.

MICA (CM) AND PAPER (CN)

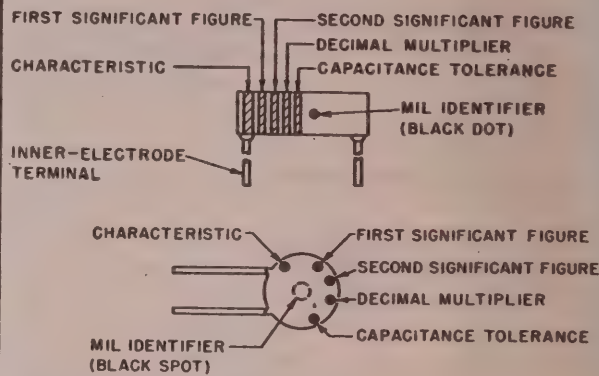


BUTTON-MICA (CB)



NOTE:
SPOTS MAY BE USED INSTEAD OF BANDS; TEMPERATURE COEFFICIENT MARKING IS LARGER.

CERAMIC-TEMPERATURE COMPENSATING (CC)



NOTES:
1. SPOTS MAY BE USED ON TUBULAR CAPACITORS; CHARACTERISTIC SPOT IS LARGER AND MIL IDENTIFIER IS ON SIDE DIAMETRICALLY OPPOSITE COLOR SPOTS.
2. MIL IDENTIFIER OF DISK TYPE IS ON REVERSE SIDE; CHARACTERISTIC SPOT IS LARGER OR SPACE BETWEEN CHARACTERISTIC AND TOLERANCE SPOTS IS THREE TIMES SPACE BETWEEN ADJACENT SPOTS.
3. TOLERANCE: YELLOW, +100%, −20%.

CERAMIC-GENERAL PURPOSE (CK)

CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE [2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC OVER 10UUF	CC 10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		−30
RED	2	100	2	C	H		X	2		2	2		−80
ORANGE	3	1,000	3	D	J	D			30				−150
YELLOW	4	10,000	4	E	P								−220
GREEN	5		5	F	R						5	0.5	−330
BLUE	6		6		S								−470
PURPLE (VIOLET)	7		7		T	W							−750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	−330(±500) [3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-C1

Figure 27. Capacitor color code.

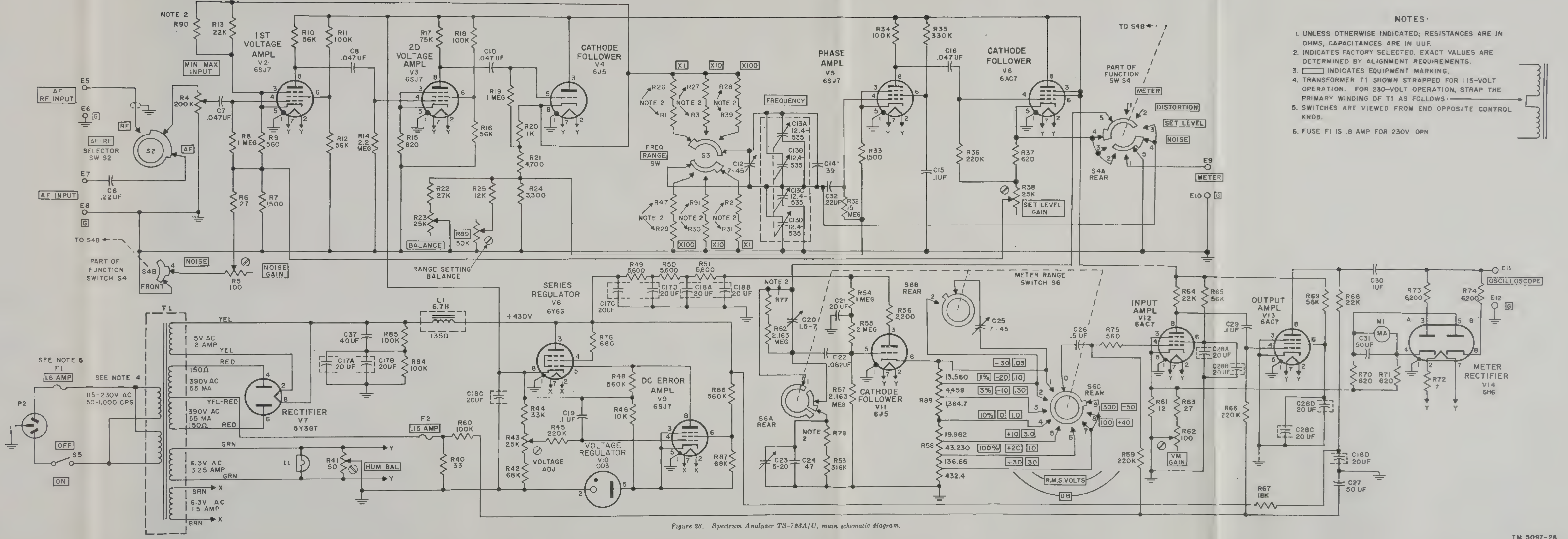
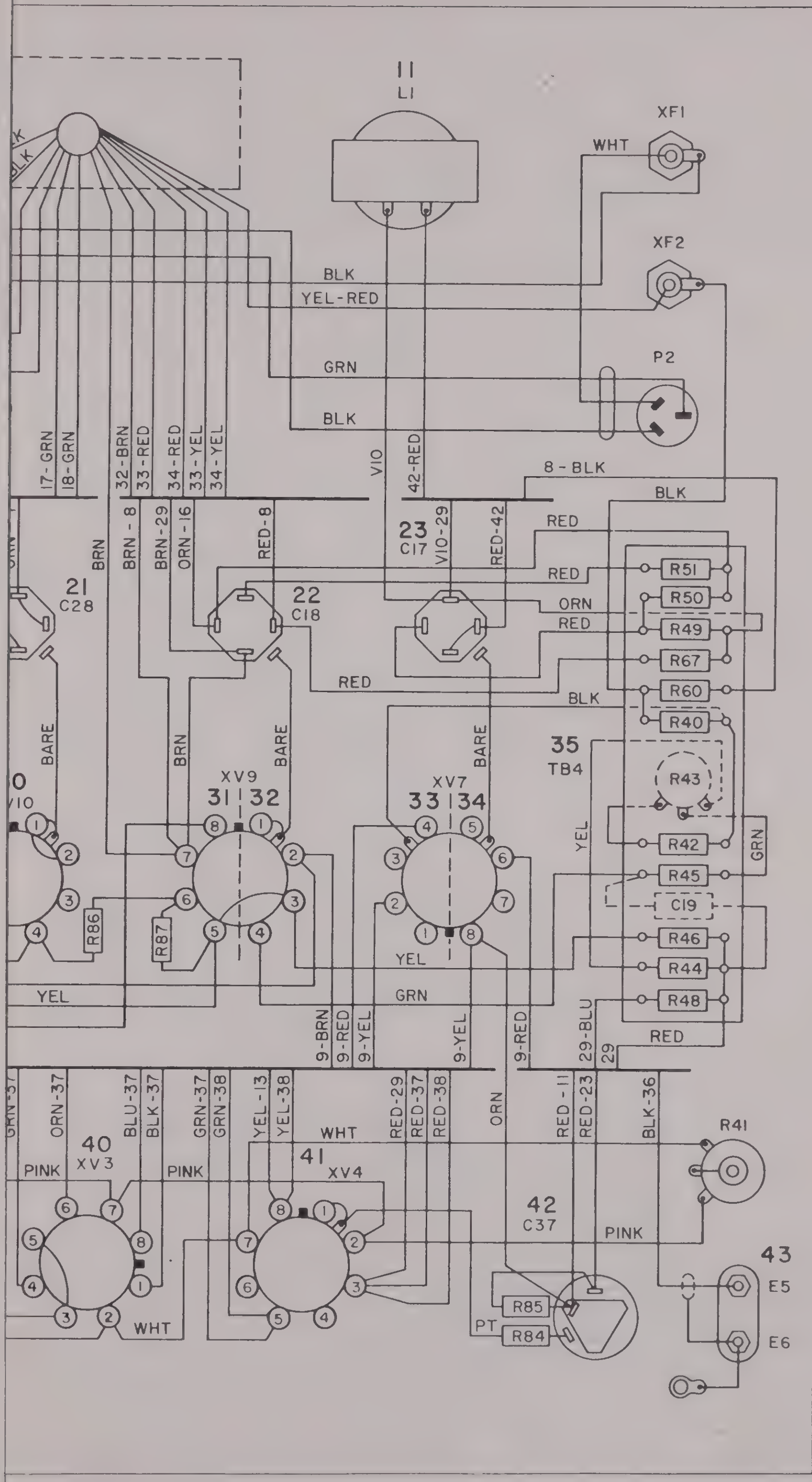
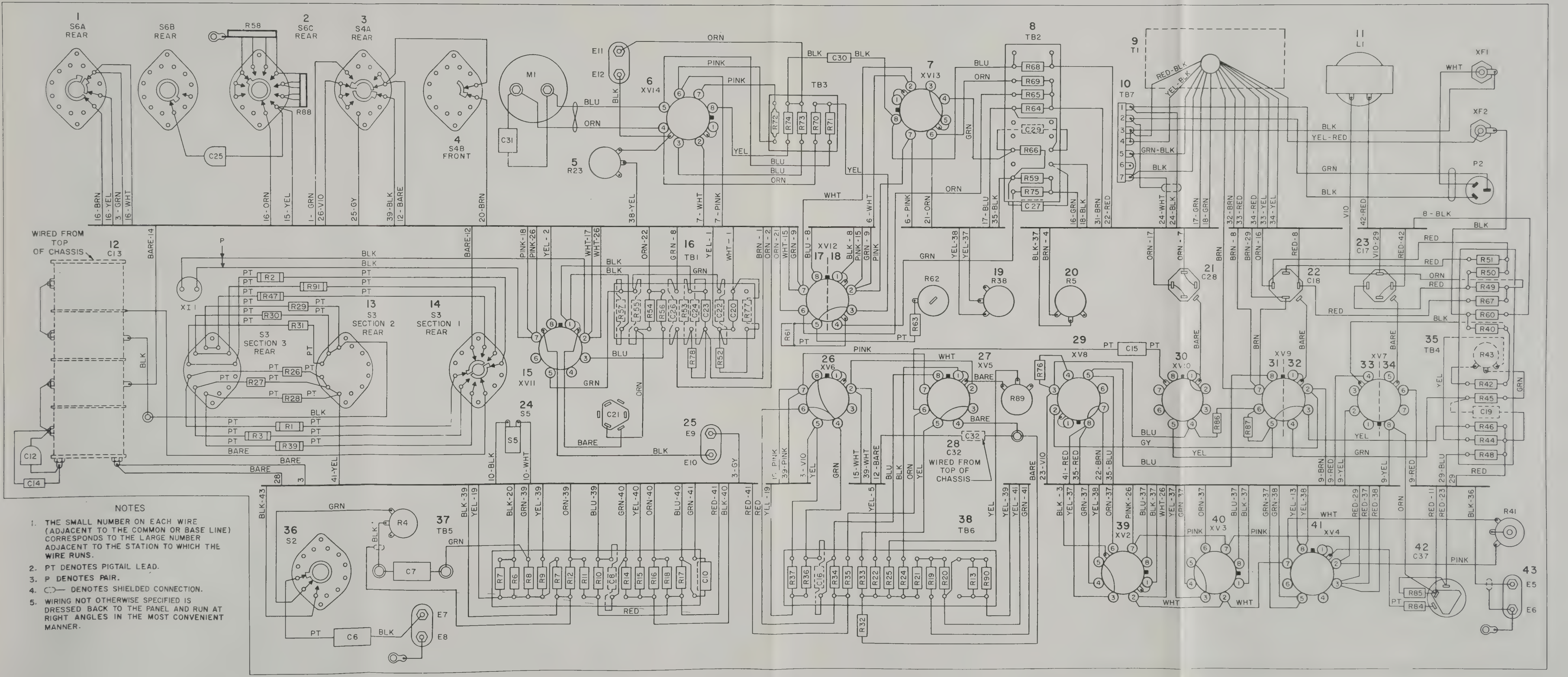


Figure 28. Spectrum Analyzer TS-723A/U, main schematic diagram.



11
L1
XF1
WHT
XF2
BLK
YEL-RED
GRN
P2
BLK
17-GRN
18-GRN
32-BRN
33-RED
34-RED
33-YEL
34-YEL
VIO
42-RED
8-BLK
BLK
RED
21
C28
BRN
BRN-8
BRN-29
ORN-16
RED-8
22
C18
23
C17
VIO-29
RED-42
RED
ORN
RED
R51
R50
R49
R67
R60
R40
RED
BLK
BARE
BARE
BARE
BRN
XV9
31 32
XV7
33 34
35
TB4
R43
YEL
R42
R45
GRN
C19
R46
R44
R48
R86
R87
YEL
YEL
GRN
9-BRN
9-RED
9-YEL
9-YEL
9-RED
29-BLU
29
RED
ORN-37
BLU-37
BLK-37
GRN-37
GRN-38
YEL-13
YEL-38
RED-29
RED-37
RED-38
ORN
RED-11
RED-23
BLK-36
40
XV3
41
XV4
WHT
PINK
PINK
R41
42
C37
PINK
43
E5
E6
R85
R84
PT
WHT

TM 5097-29



NOTES

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. PT DENOTES PIGTAIL LEAD.
3. P DENOTES PAIR.
4. (⊂⊃)— DENOTES SHIELDED CONNECTION.
5. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.

Figure 29. Spectrum Analyzer TS-723A/U, wiring diagram.

TM 5097-29

INDEX

[AG 413.6 (14 Jan 57)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:
HERBERT M. JONES,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

CNGB
ASA
Tec Svc, DA
Tec Svc Bd
Hq CONARC
CONARC Bd
CONARC Bd Test Sec
Army AA Comd
OS Maj Comd
OS Base Comd
Log Comd
MDW
Armies
Corps
Ft & Cp
Sp Wpn Comd
SPWAR Cen
Army Cml Cen
Gen & Br Svc Sch
Gen Depots
Sig Sec, Gen Depots
Sig Depots
US Army Tng Cen
POE (OS)
Trans Terminal Comd
Army Terminals
OS Sup Agencies
Army Elct PG
Sig Fld Maint Shops
Sig Lab
ACS
Mil Dist
Units organized under following TOE's:
11–7C
11–16C
11–57C
11–127R
11–128C
11–500R
11–557C
11–587R
11–592R
11–597R

NG: State AG; units—same as Active Army.

USAR: None.

For explanation of abbreviations used, see SR 320–50–1.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1973 O - 510-508 (7366A)

SPECTRUM ANALYZERS TS-723A/U AND TS-723B/U

TM 11-5097
TO 33A1-5-64-1
CHANGES No. 1

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D. C., *13 July 1959*

TM 11-5097/TO 33A1-5-64-1, 24 January 1957, is changed as follows:

Change the title of the manual to:

SPECTRUM ANALYZERS TS-723A/U AND TS-723B/U.

Page 3, chapter 1. Add the following note below the title of chapter 1.

Note. Spectrum Analyzer TS-723B/U is similar to Spectrum Analyzer TS-723A/U. Information in this manual applies to both sets unless otherwise specified.

Paragraph 1*a*, line 3. After "(fig. 1)," add: and Spectrum Analyzer TS-723B/U.

Page 4. Add paragraph 7.1.

7.1 Difference in Models
(Added)

Spectrum Analyzer TS-723B/U differs from TS-723A/U in the following details:

a. Components, finishes, and construction practices are militarized wherever possible.

b. The metal cover is not perforated. Nine louvers in the rear of the cover provide ventilation.

c. Potentiometer R4 is the signal INPUT control in TS-723A/U and the signal AF INPUT control in TS-723B/U. (Throughout the manual the term INPUT is used.)

d. There are no AF-RF binding posts on the B model.

e. There is no AF-RF selector switch on the B model.

f. There is an indicator lamp on the front panel of the B model.

g. In the B model, the power fuses and power cord (fig. 3.1) are located on the front panel. Two fuse holders with spare fuses are also mounted on the front panel.

Page 7, paragraph 13. Make the following changes:

Subparagraph *a*. Delete subparagraphs (2) and (3) and substitute:

(2) For the A model, refer to block 10 on figure 29 and disconnect the jumpers connected between terminals 3 and 4 and 5 and 7 on terminal board TB7 (fig. 20). Connect and solder a piece of #18 AWG bare copper wire between terminals 4 and 5 on TB7.

(3) For the B model, refer to block 42 on figure 29.1 and disconnect jumpers connected between terminals 1 and 3 and 2 and 4 on transformer T1 (fig. 20.1). Connect and solder a piece of #18 AWG bare copper wire between terminals 2 and 3 on T1.

Subparagraph *b*. Delete subparagraphs (1) and (2) and substitute:

(1) Remove the bottom cover and follow the instructions given in *a*(2) above. For the A model (fig. 29), disconnect the jumpers connected between terminals 4 and 5 on TB7. (fig. 30). Connect and solder a piece of #18 AWG insulated copper wire between terminals 3 and 4 and another between terminals 5 and 7 on TB7.

(2) For the B model, connect the same type of wire between terminals 1 and 3 and 2 and 4 on T1. Refer to figure 29.1. Disconnect the jumper connected between terminals 2 and 3 on T1 (fig. 20.1).

Paragraph 14*a*(2). Make the following changes:

At the beginning of the first sentence, add: in the A model. At the end of the subparagraph (2), add: In the B model, the power cord is terminated with connector plug UP–121M.

Page 8, paragraph 16. Make the following changes:

Heading. Delete "(figs. 3 and 4)" and substitute: (fig. 3, 3.1, 4, and 4.1).

Chart. Make the following changes:

Add the following after the first item:

Control or instrument	Function
On-off indicator lamp (B model only).	Glows when ON-OFF switch is ON.

In "Control and instrument" column, line 3, add the following: (A model only).

In "Function" column, line 5, add the following: Leave switch in AF position.

Page 9, figure 3. Change caption to: Front panel controls and instruments, TS–723A/U.

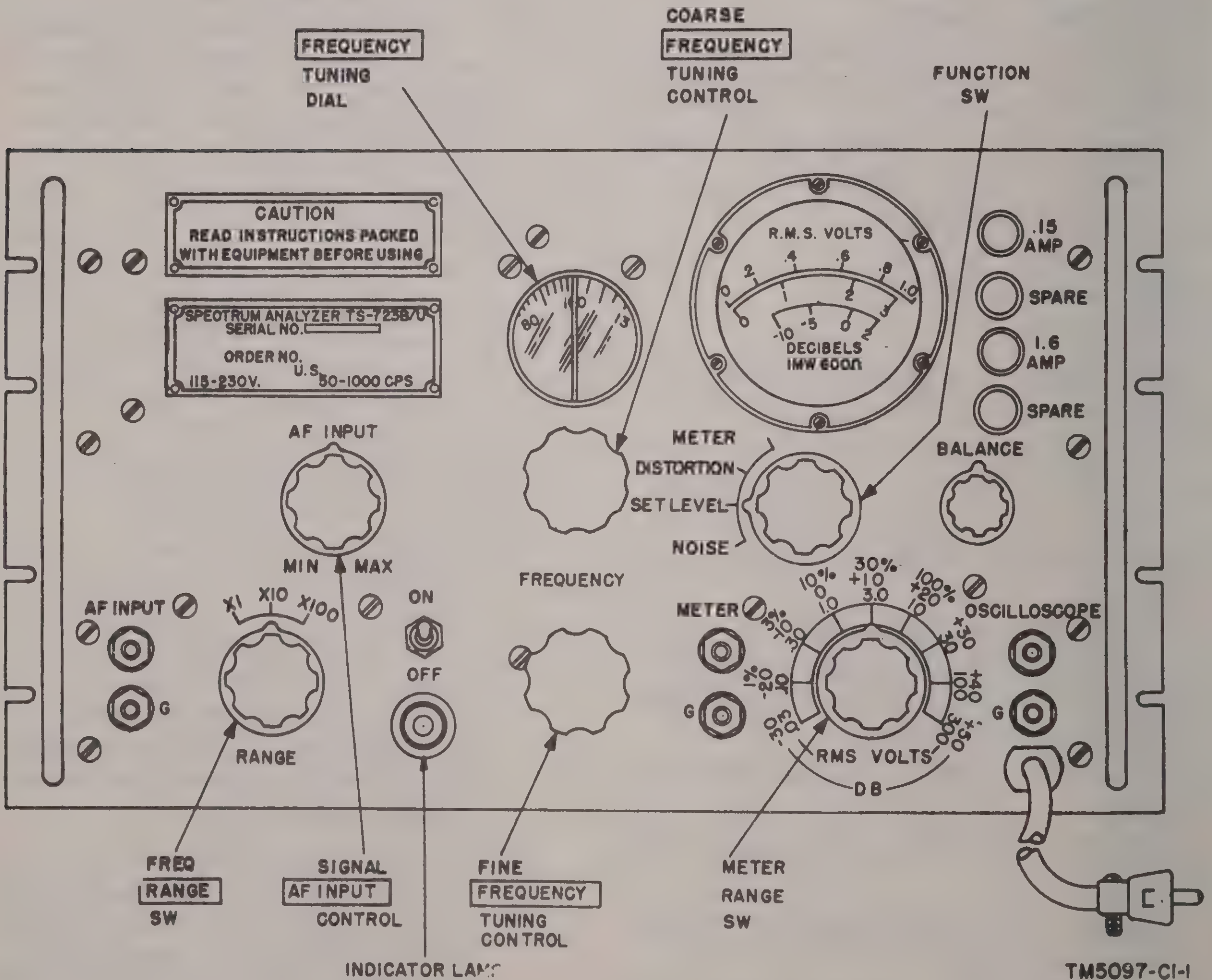
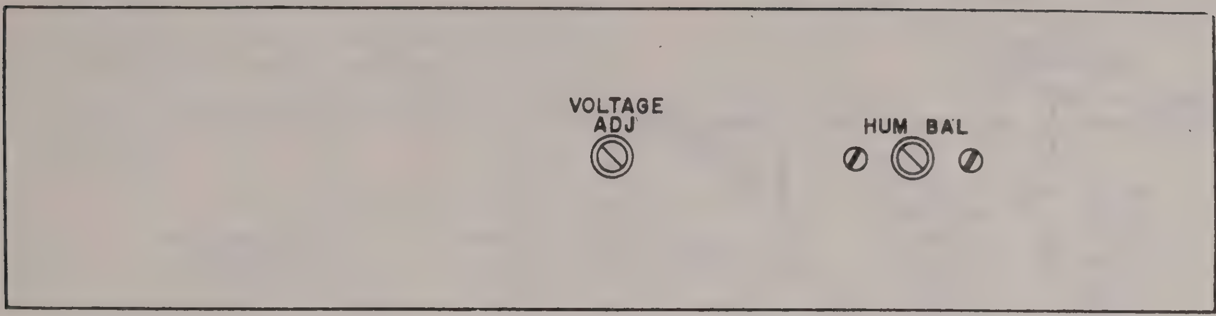


Figure 3.1. (Added) *Front panel controls and instruments, TS–723B/U.*

Figure 4. Change caption to: Spectrum analyzer, rear panel view, TS–723A/U.



TM5097-CI-2

Figure 4.1. (Added) Spectrum analyzer, rear panel view, TS–723B/U.

Page 10, paragraph 18*b*. After "switch," add: (A model only).

Page 11, paragraph 21, line 1. After "switch," add: (A model only).

Page 12, paragraph 23*b*. After "switch," add: (A model only).

Page 20, paragraph 39, chart. Items Nos. 6, 7, and 8, line 1. After switch, add: (A model only).

Page 21, paragraph 40, line 2. After "TS–723A/U" add: and TS–723B/U.

Subparagraph *b*, line 6. After "(fig. 16)," add: in the A model. In the B model, the cathode resistors are R92 through R98 (fig. 16.1).

Page 23, paragraph 41*a*. Make the following changes:

At the beginning of the second sentence, add: In the A model

Line 8. Change "RF" to: AF

Line 9. Change "AF–RF INPUT" to: AF INPUT

Delete the last sentence.

Page 24, figure 10. Delete the note and substitute:

NOTES:

1. R90 IS A FACTORY-SELECTED RESISTOR.

2. S2, E5, AND E6 ARE NOT USED IN THE B MODEL. C6 IS CONNECTED DIRECTLY TO R4.

Page 25, figure 11. Change the word "NOTE" to: NOTES.

Add the following:

1. IN THE B MODEL, R1 and R2 ARE 7.5 MEG; R3 AND R91 ARE 750K; R39 AND R47 ARE 75K.

2. IN THE B MODEL, C12 IS 5–20 UUF.

Page 29, paragraph 46. Make the following changes:

Subparagraph *a*. At the end of the first sentence, add: for the A model. See figure 16.1 for the B model.

Line 4. Delete "R88 and R58." Change "conected" to: connected.

Lines 8 and 9. Delete "R88 and R58" and substitute: the cathode resistance.

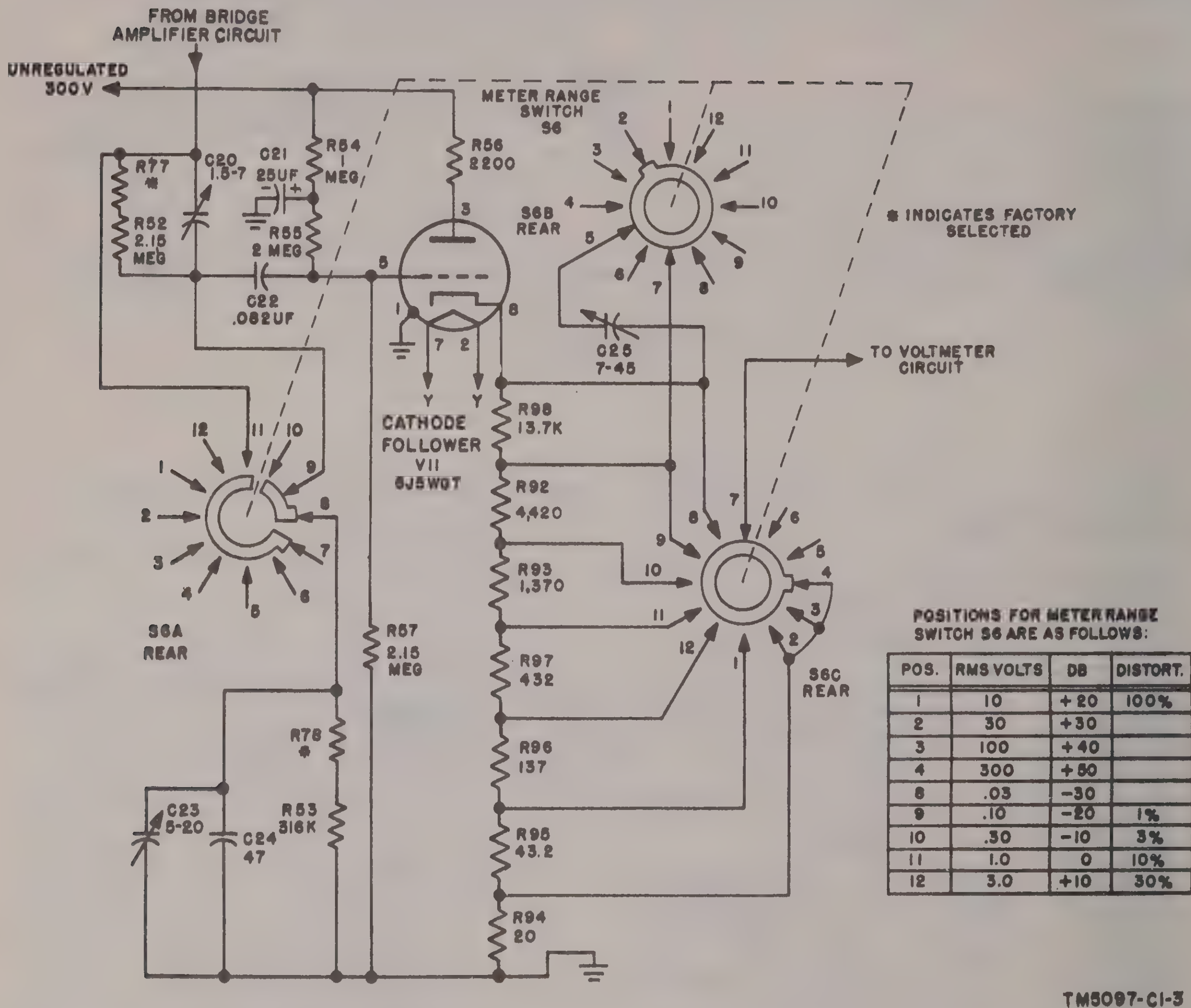
Add the following note at the end of the subparagraph:

Note. In the A model, the cathode resistance is composed of multisection resistors R88 and R58. In the B model, the resistance is made up of R92 through R98.

Subparagraph *e*. Delete the first sentence and substitute: Resistors R88 and R58 in the A model (R92 through R98 in the B model) form part of the cathode biasing network.

Line 3. Delete "R58 and R88" and substitute: the cathode resistance.

Figure 16. Change caption to: TS–723A/U, Voltage divider circuit, simplified schematic diagram.



POS.	RMS VOLTS	DB	DISTORT.
1	10	+20	100%
2	30	+30	
3	100	+40	
4	300	+50	
8	.03	−30	
9	.10	−20	1%
10	.30	−10	3%
11	1.0	0	10%
12	3.0	+10	30%

Figure 16.1. (Added) *TS–723B/U, voltage divider circuit, simplified schematic diagram.*

Page 30, paragraph 46*e*, line 6. Delete "R88 and R58" and substitute: the cathode resistance.

Paragraph 47*b*, line 6. Add the following after "C28D:" (C38B in the B model).

Figure 17. Add the following note to figure 17.

NOTE:

CAPACITOR C28D is C38B in the B model.

Page 31, paragraph 48. Make the following changes: Subparagraph *a*, line 14. Add the following after "C17D:" (C18C in the B model).

Subparagraph *e*, line 6. Add the following after "C18C:" (C38A in the B model).

Page 32, figure 18. Change the word "NOTE" to NOTES. Number the existing note "1" and add the following:

2. IN THE B MODEL, I 1 IS DS2, AND

DS1 IS ADDED IN PARALLEL TO IT; C17D, C18C, AND C18D ARE C18C, C38A, AND C38C RESPECTIVELY.

Page 33, paragraph 48*h*, line 2. Add the following after "C18D:" (C38C in B model).

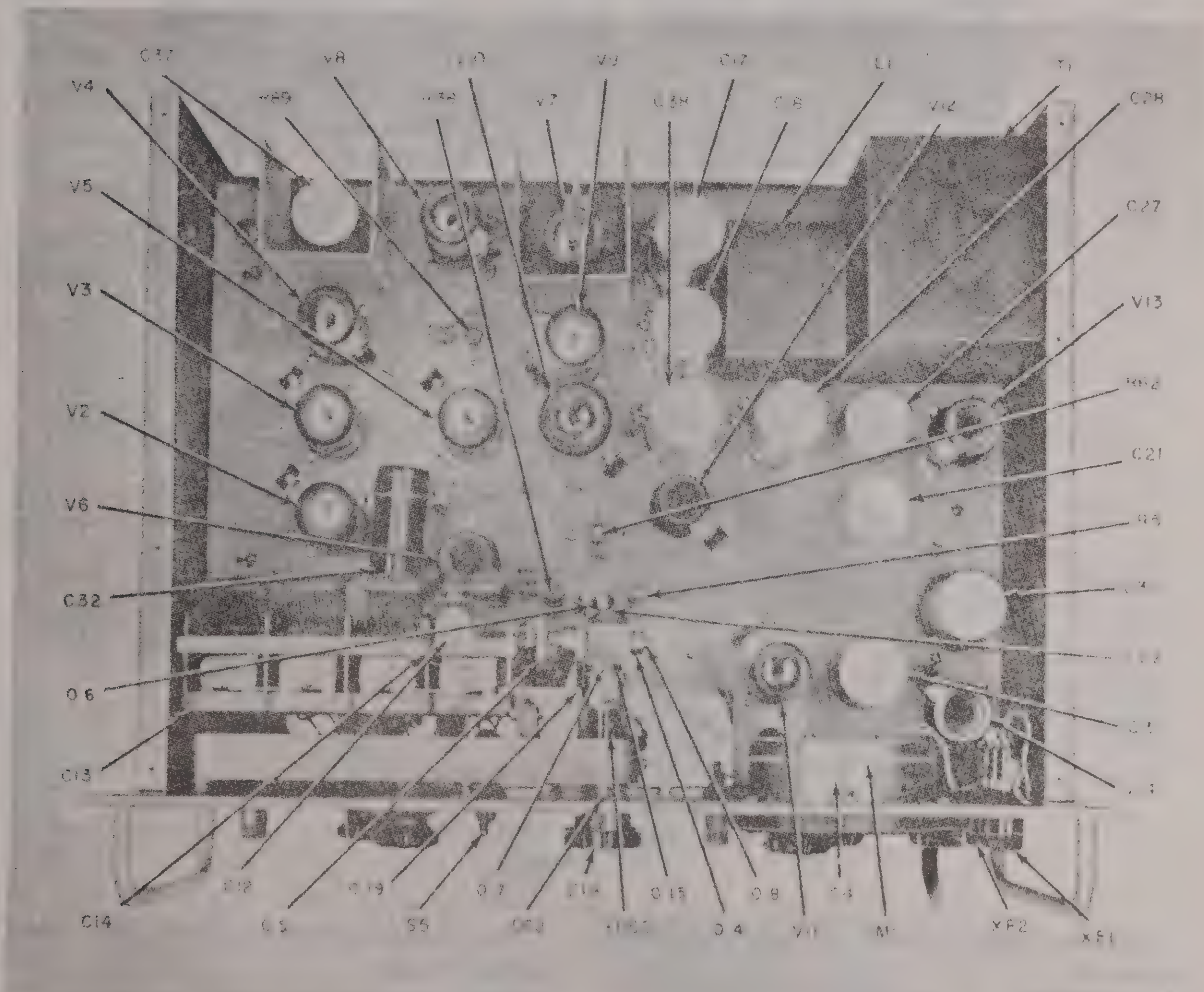
Page 35, paragraph 53. Make the following changes:

Subparagraph *d*, line 1. Add the following after "C18D:" (C38C in the B model).

Subparagraph *e*, line 3. Add the following after "C17D:" (C18C in the B model).

Page 36, line 2. Change "R3" to: R43.

Figure 19. Change caption to: TS–723A/U, top view of chassis.



TM5097-C1-4

Figure 19.1 (Added) *TS–723B/U, top view of chassis.*

Page *37*, figure 20. Change caption to: TS–723A/U, bottom view of chassis.

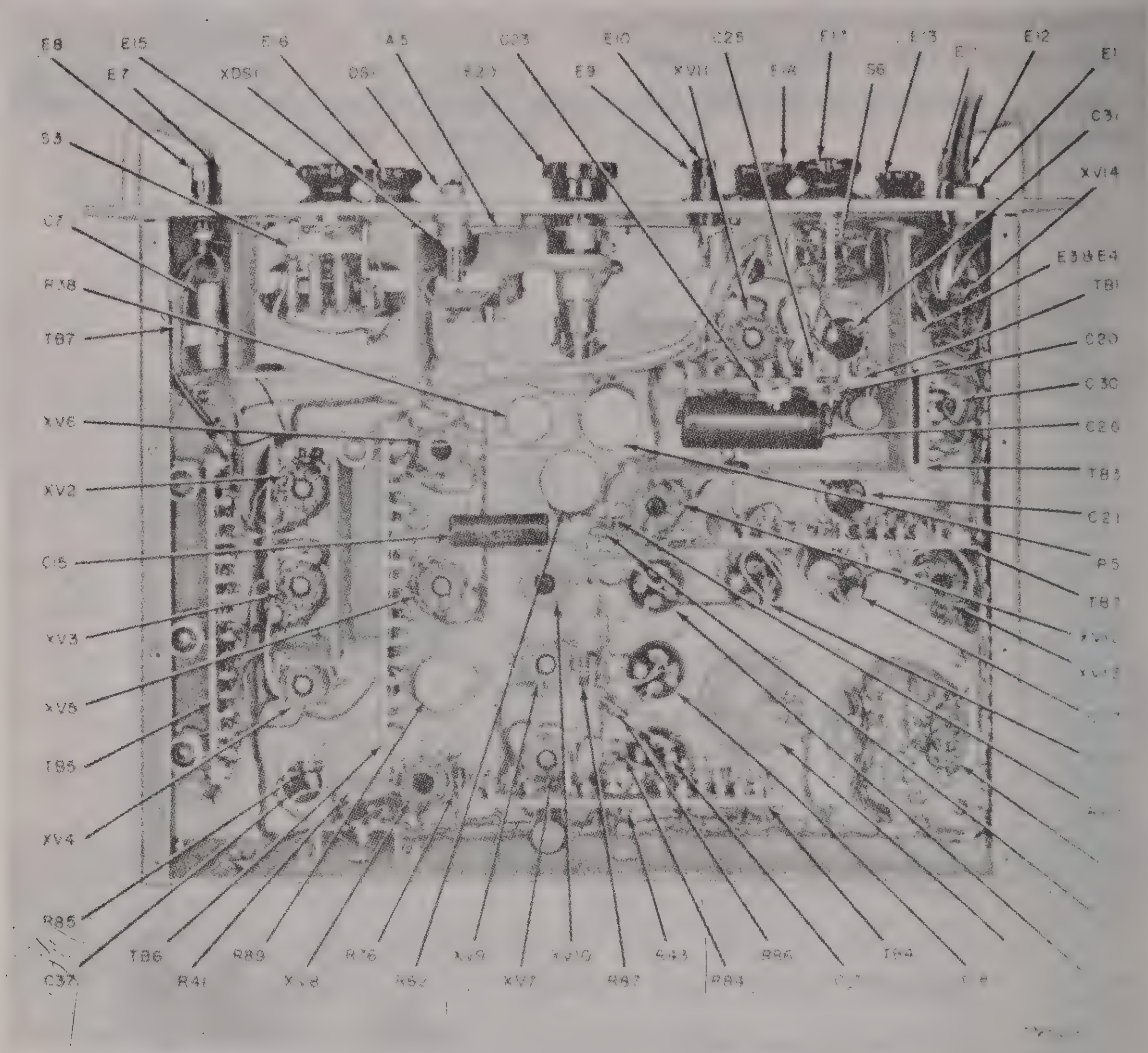


Figure 20.1. (Added) *TS–723B/U, bottom view of chassis.*

Page 38, figure 21. Add the following note to figure 21:

NOTE:

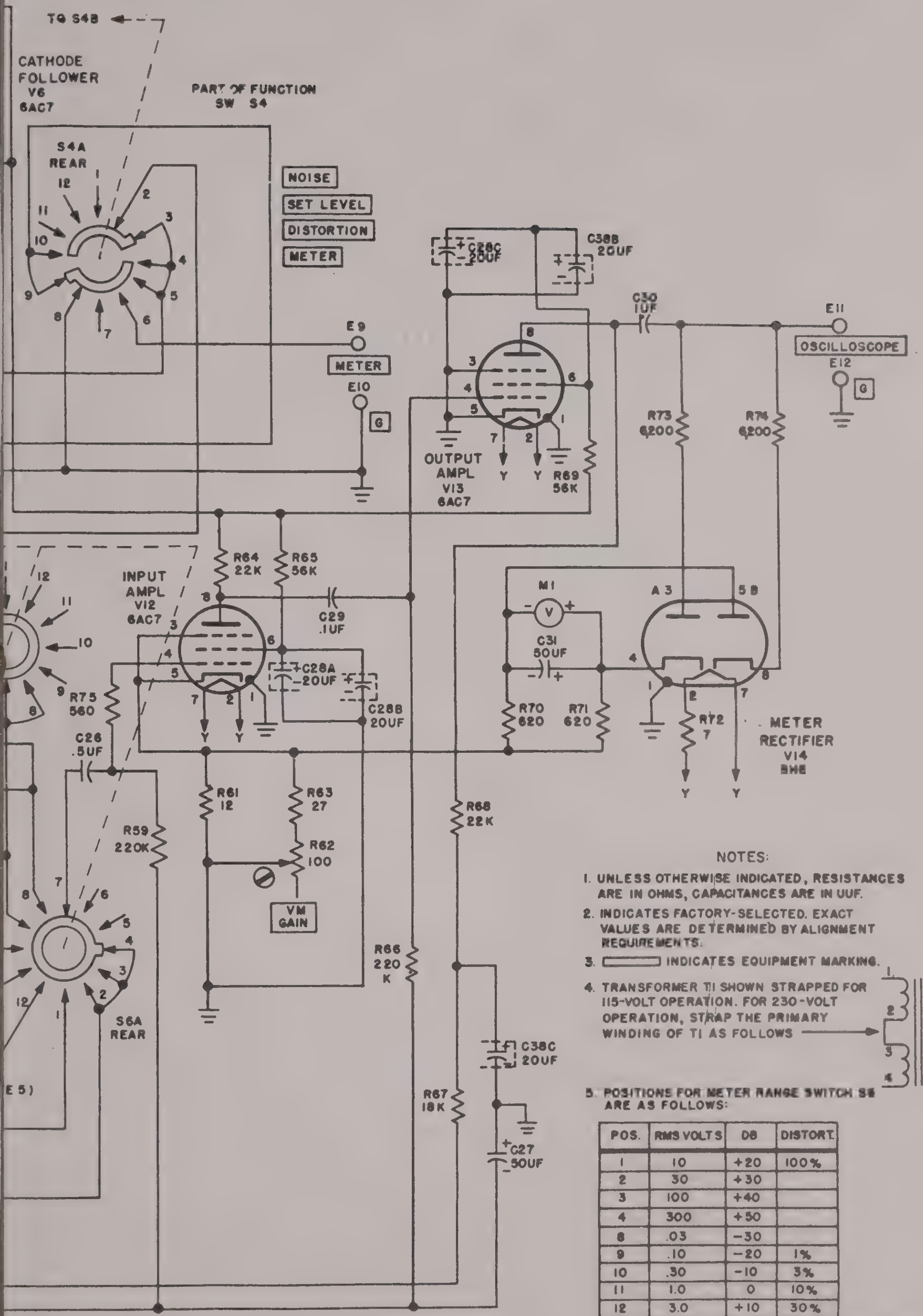
IN THE B MODEL, C17D, C18C, AND C18D ARE C18C, C38A, AND C38C RESPECTIVELY.

Page 40, figure 23. In the upper left section of the illustration, on TB3, change "R12" to: R72.

Page 41, paragraph 54, chart. Make the following changes:

"Symptom" column, line 16. Add the following after "AF–RF selector switch S2": (in the A model only).

"Probable trouble" column, line 1. Add the following after "I 1:" (DS2 in the B model).



NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. INDICATES FACTORY-SELECTED. EXACT VALUES ARE DETERMINED BY ALIGNMENT REQUIREMENTS.
3. ▭ INDICATES EQUIPMENT MARKING.
4. TRANSFORMER T1 SHOWN STRAPPED FOR 115-VOLT OPERATION. FOR 230-VOLT OPERATION, STRAP THE PRIMARY WINDING OF T1 AS FOLLOWS →
5. POSITIONS FOR METER RANGE SWITCH S6 ARE AS FOLLOWS:

POS.	RMS VOLTS	DB	DISTORT.
1	10	+20	100%
2	30	+30	
3	100	+40	
4	300	+50	
8	.03	−30	
9	.10	−20	1%
10	.30	−10	3%
11	1.0	0	10%
12	3.0	+10	30%

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Page 37, figure 20. Change caption to: TS–723A/U, bottom view of chassis.

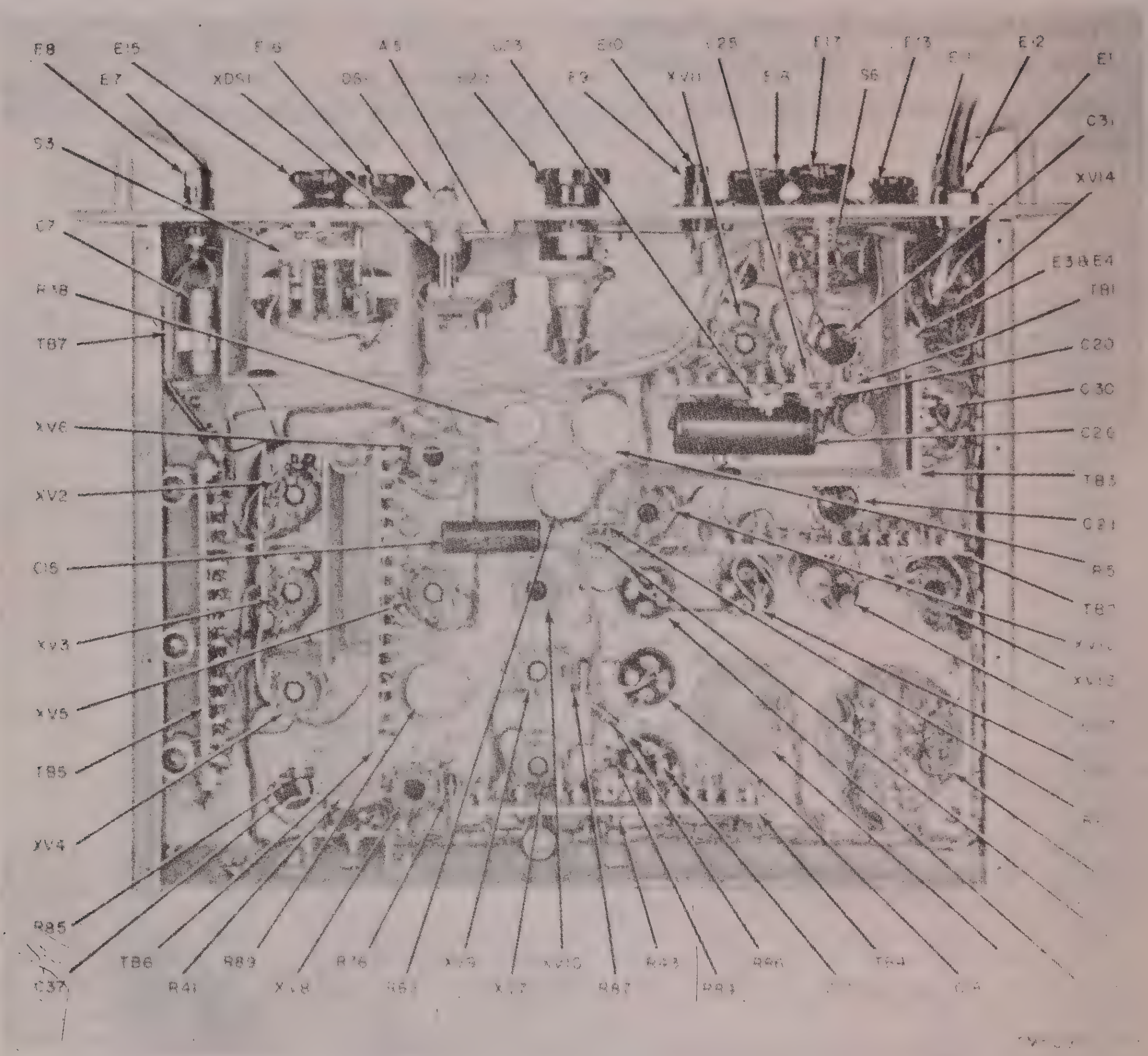


Figure 20.1. (Added) *TS–723B/U, bottom view of chassis.*

Page 38, figure 21. Add the following note to figure 21:

NOTE:

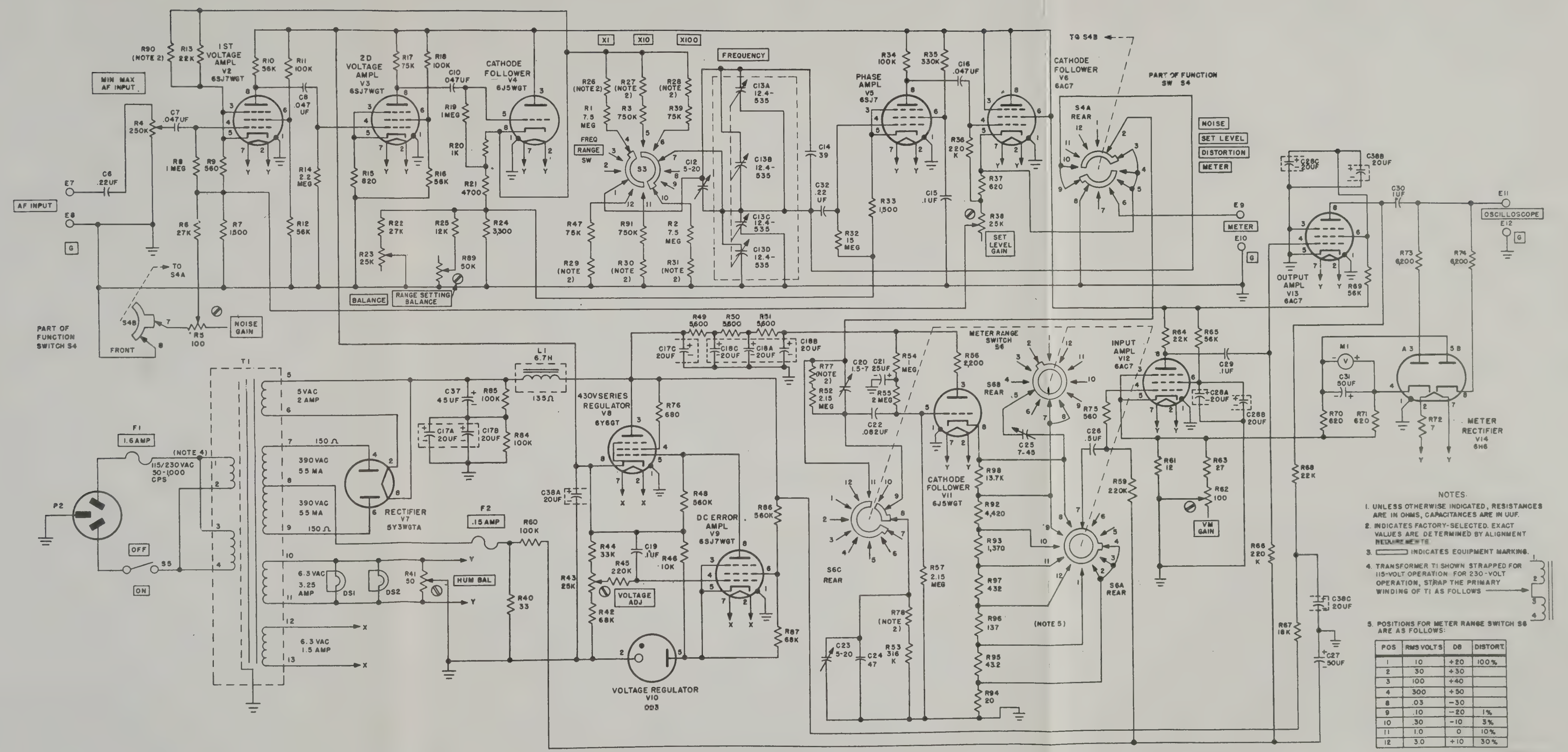
IN THE B MODEL, C17D, C18C, AND C18D ARE C18C, C38A, AND C38C RESPECTIVELY.

Page 40, figure 23. In the upper left section of the illustration, on TB3, change "R12" to: R72.

Page 41, paragraph 54, chart. Make the following changes:

"Symptom" column, line 16. Add the following after "AF–RF selector switch S2": (in the A model only).

"Probable trouble" column, line 1. Add the following after "I 1:" (DS2 in the B model).



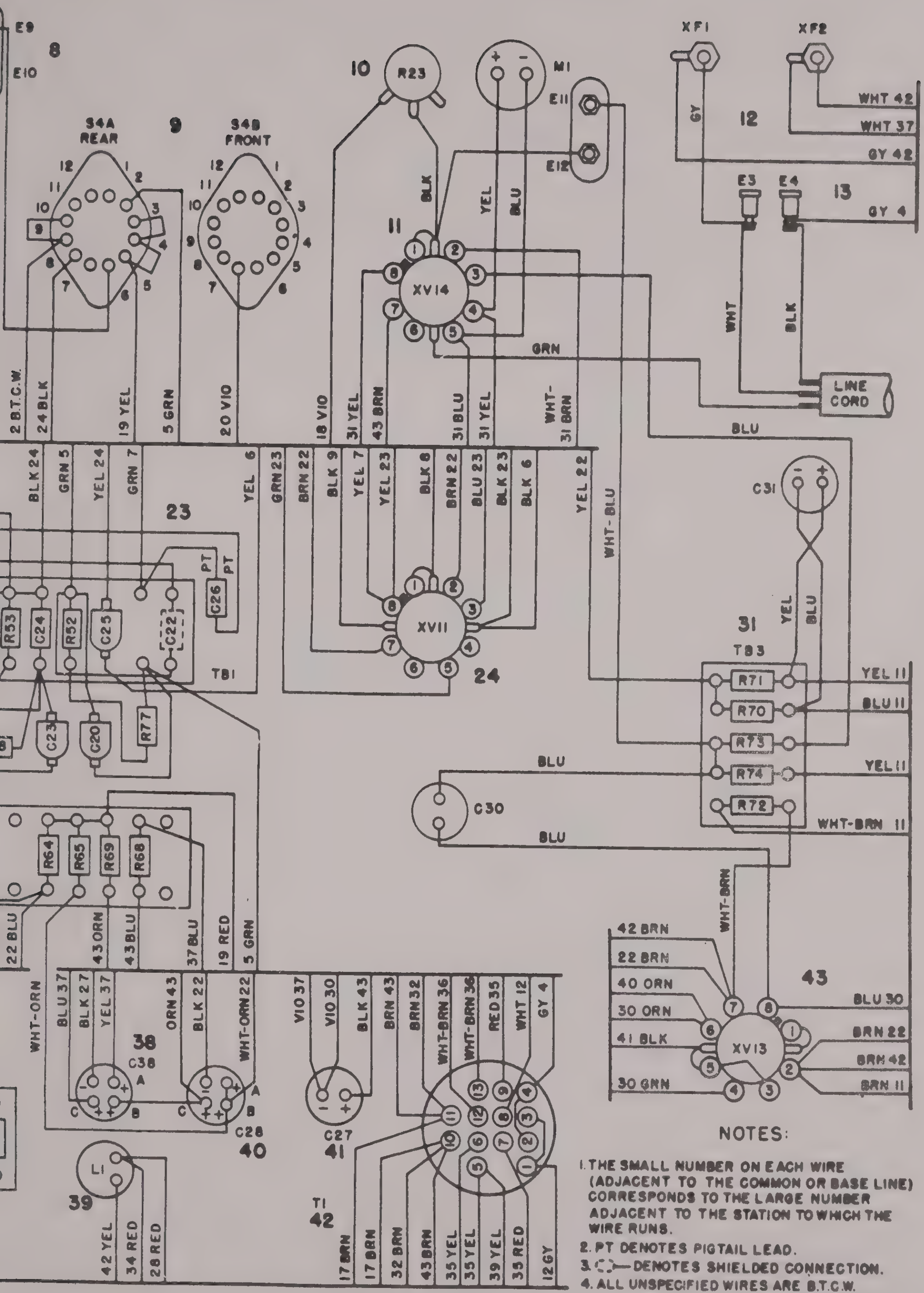
NOTES.

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. INDICATES FACTORY-SELECTED. EXACT VALUES ARE DETERMINED BY ALIGNMENT REQUIREMENTS.
3. ▭ INDICATES EQUIPMENT MARKING.
4. TRANSFORMER T1 SHOWN STRAPPED FOR 115-VOLT OPERATION. FOR 230-VOLT OPERATION, STRAP THE PRIMARY WINDING OF T1 AS FOLLOWS →
5. POSITIONS FOR METER RANGE SWITCH S6 ARE AS FOLLOWS:

POS	RMS VOLTS	DB	DISTORT.
1	10	+20	100%
2	30	+30	
3	100	+40	
4	300	+50	
8	.03	-30	
9	.10	-20	1%
10	.30	-10	3%
11	1.0	0	10%
12	3.0	+10	30%

TM5097-C1-6

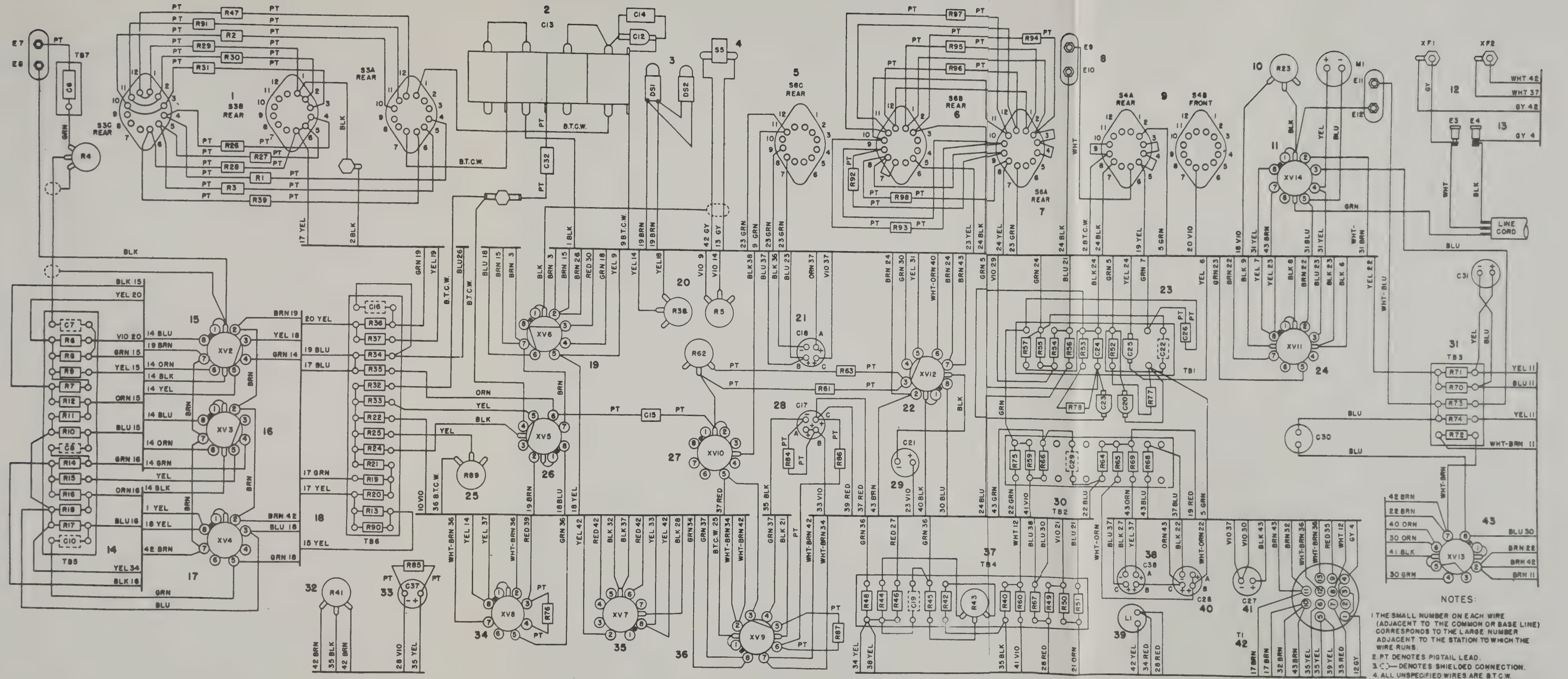
Figure 28.1. (Added) Spectrum Analyzer TS-723B/U, main schematic diagram.



NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. PT DENOTES PIGTAIL LEAD.
3. —DENOTES SHIELDED CONNECTION.
4. ALL UNSPECIFIED WIRES ARE B.T.C.W.

TM5097-C1-7



NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. PT DENOTES PIGTAIL LEAD.
3. ⊂⊃— DENOTES SHIELDED CONNECTION.
4. ALL UNSPECIFIED WIRES ARE B.T.C.W.

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Figure 29.1. (Added) Spectrum Analyzer TS–723B/U, wiring diagram.

"Correction" column. Delete the note and substitute:

Note. In the A model, switch S6 must be replaced as an assembly including R58, R88, and C25. In the B model, R58 and R88 and R92 through R98. Capacitor C25 is not included on the S6 switch assembly.

Page 42, paragraph 55. Make the following changes:

Note, line 7. After "R88," add: (R92 through R98).

Subparagraph *b*. Add the following before the first sentence: In the A model,

Page 44, paragraph 56*a*(10), line 5. After "XI 1," add: (XDS2 in the B model).

Page 47, figure 25. Make the following changes:

Change nomenclature for "0 7" to: idler shaft.

Change nomenclature for "0 9" to: dial hub.

Add the following note:

NOTE:

IN THE B MODEL, THE 0 3 DIAL SHAFT IS FREE TO MOVE AND REFERENCE SYMBOLS 0 3A AND 0 3B HAVE BEEN ASSIGNED TO SHAFT AND COLLAR RESPECTIVELY. I 1 IS DS2 and XI 1 IS XDS2.

Page 48, paragraph 56*b*(12), line 1. After "XI 1," add: (XSD2 in the B model).

Page 49, paragraph 58*b*(6), last line. After "C18D," add: (C38C in the B model).

Page 50, paragraph 58*d*(10), line 2. After "+3," add: percent.

Page 51, paragraph 58. Make the following changes:

Subparagraph *d*(18), lines 4 and 7. Delete "200" and substitute: 250.

Subparagraph *d*(19), last line. Delete "200" and substitute: 250.

Subparagraph *d*(20), line 3. Delete "200" and substitute: 250.

Page 52, paragraph 58*f*(3) and *g*(3). After "switch," add: (in the A model only).

Page 53, paragraph 58*h*(4). After "switch," add: (in the A model only).

Figure 28, (fold-out). Add the following to the notes:

7. IN THE B MODEL, C12 IS 5–20 UUF.

[AG 413.6 (6 Jul 59)]

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

L. L. LEMNITZER,
General, United States Army,
Chief of Staff.

OFFICIAL:
R. V. LEE,
Major General, United States Army,
The Adjutant General.

THOMAS D. WHITE,
Chief of Staff, United States Air Force.

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  11–16 (2)
  11–57 (2)
  11–97 (2)
  11–98 (2)
  11–117 (2)
  11–155 (2)
  11–500 (AA–AE) (2)
  11–557 (2)
  11–587 (2)
  11–592 (2)
  11–597 (2)
  33–56 (2)

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1974 O - 557-791

TECHNICAL MANUAL

SPECTRUM ANALYZERS TS-723A/U, TS-723B/U, AND TS-723C/U

TM 11-5097
CHANGES No. 2

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *17 March 1961*

TM 11-5097, 24 January 1957, is changed as indicated so that the manual also applies to the following equipment:

Nomenclature	*Order No.*	*Serial No.*
Spectrum Analyzer TS-723C/U---	4530-PP-60	1-550

Change the title of the manual to: **SPECTRUM ANALYZERS TS-723A/U, TS-723B/U, AND TS-723C/U.**

Note. The parenthetical reference to previous changes (example: "page 3 of C 1") indicates that pertinent material was published in those changes.

Page 3, chapter 1, note (page 1 of C 1). Designate the existing note "1" and add the following:

2. Spectrum Analyzer TS-723C/U is similar to Spectrum Analyzer TS-723B/U. Information in this manual applies to both sets unless otherwise specified.

Paragraph 1*b*.

b. (Superseded) Forward comments on this manual direct to the Commanding Officer, U.S. Army Signal Materiel Support Agency, ATTN: SIGMS-PA2*d*, Fort Monmouth, N.J.

7.2. Differences Between TS-723B/U and TS-723C/U
(Added)

The TS-723C/U differs from the TS-723B/U as follows:

a. The frequency dials are marked COARSE and FINE.

b. Engraved markings on the panels are colored black instead of white.

c. A double-pole, double-throw switch is incorporated into the primary circuit of the power transformer to provide for 115-volt or 230-volt operation. The switch is located at the rear of the chassis and is equipped with a locking plate so marked that the proper voltage is indicated when the toggle switch is locked in position by the locking plate.

Page 7, paragraph 13, heading. Add after the heading: **(For TS-723A/U and TS-723B/U only.)**

13.1. Power Transformer (TS-723C/U)
(Added)

A switch has been added in the primary circuit of power transformer T1, which provides for 115-volt or 230-volt operation directly without any need to change the transformer strapping or wiring. A locking plate fits over the toggle switch and is screwed to the rear of the chassis so that the toggle switch cannot accidentally be operated or change positions after it has been properly set. Set this switch to correspond to the voltage source being used. Change fuse F1 to 0.8-amp for 230-volt operation or to 1.6-amp for 115-volt operation.

***Caution:* When operating from a 230-volt source, never set this switch to the 115-volt position.**

Page 8, paragraph 16 (page 2 of C 1). Make the following changes:

Heading. Change "(fig. 3, 3.1, 4, and 4.1)" to: (fig. 3, 3.1, 4, 4.1, and 4.2).

Chart. Add the following after the last item:

Control or instrument	Function
115V-230V ac changeover switch (TS-723C/U only).	Connects power transformer primary windings in series for 230-volt operation or in parallel for 115-volt operation.

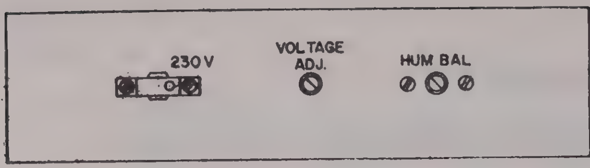

Figure 4.2. (Added) *Spectrum Analyzer TS–723C/U, rear-panel view.*

Page 20, paragraph 39, chart. After Item No. 3, add the following:

Item No.	Item	Action or condition	Normal indications
3. 1	115V–230V switch (TS–723C/U only).	Set to correspond with source voltage being used.	Refer to paragraph 13.1.

Page 33, paragraph 48*i*, line 8. After "paragraph 13" add: (or par. 13.1 and fig. 18.1 for TS–723C/U).

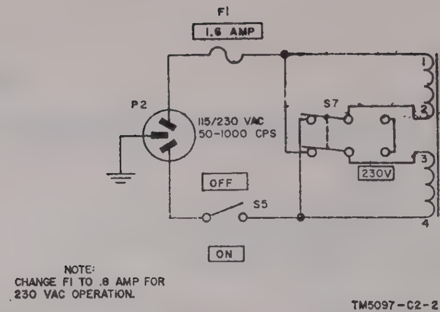

Figure 18.1. (Added) *Spectrum Analyzer TS–723C/U, 115V–230V changeover switch circuit, partial schematic diagram.*

Page 35, paragraph 50, chart. After figure 20, add the following:

Fig. No.	Title
20.1	TS–723B/U, bottom view of chassis.
20.2	TS–723C/U, bottom view of chassis.

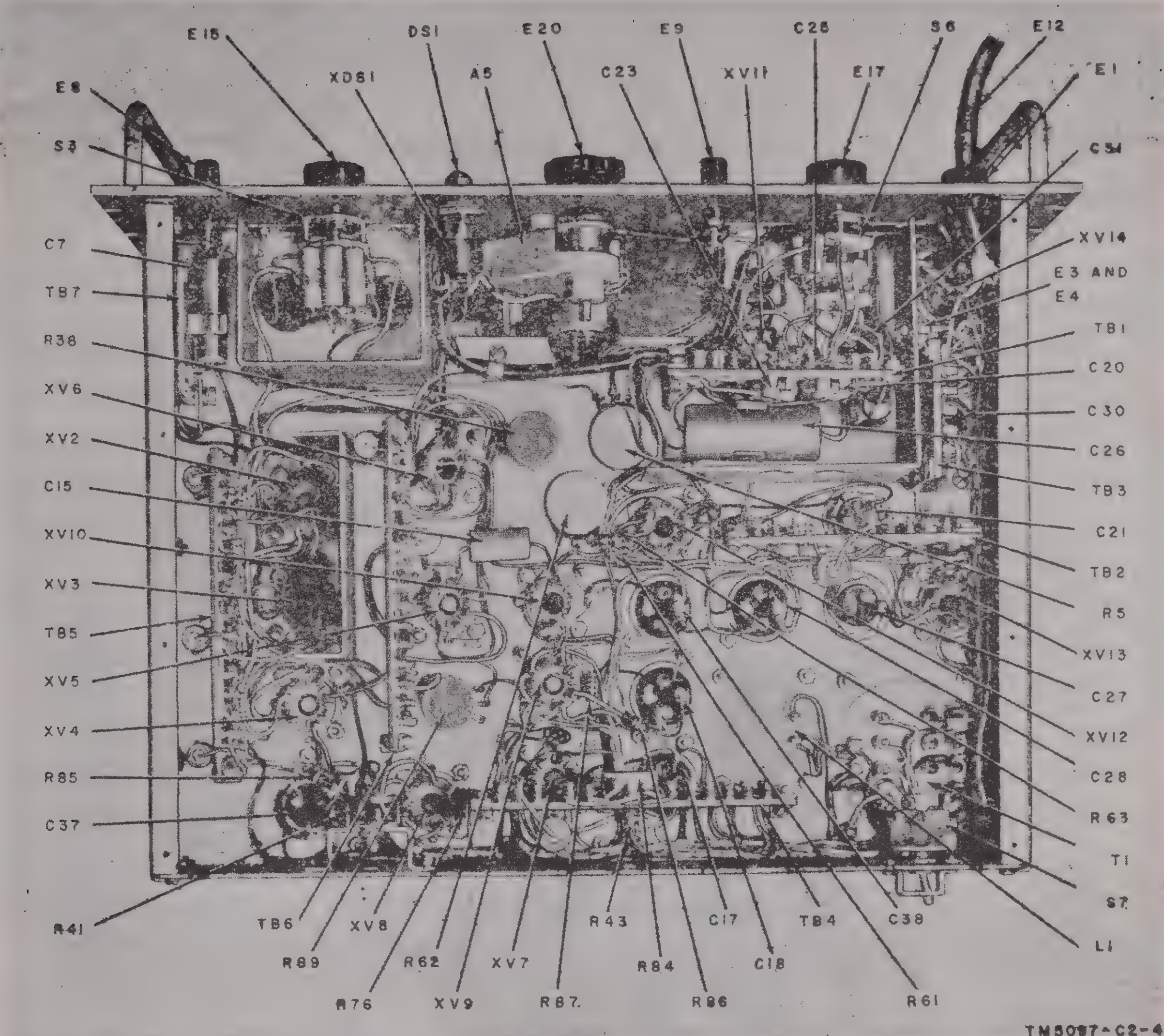

Figure 20.2. (added) *TS-723C/U, bottom view of chassis.*

Page 41, paragraph 54, chart, *Probable trouble* column. Make the following changes: Line 3. After "T1" add: (TS-723A/U and TS-723B/U only).

Line 5. After line 5, add:

Probable trouble	Correction
115V-230V ac changeover switch (TS-723C/U) set to wrong position.	Set switch to correct position (par. 13.1).

Page 58, figure 28.1 (fold-out) (page 6 of C 1). Add the following to the notes:

6. FUSE F1 IS .8 AMP FOR 230V OPN.
7. IN TS-723C/U, 115V-230V CHANGEOVER SWITCH S7 HAS BEEN ADDED TO PRIMARY OF T1, THIS ELIMINATES STRAPPING OF T1 BY HAND FOR CHANGEOVER FROM 115-VOLT TO 230-VOLT OPERATION OR VICEVERSA.

After "F1" add: (Note 6).

BY ORDER OF THE SECRETARY OF THE ARMY:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General.

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MDW (2)	11-7	11-557
Seventh USA (2)	11-16	11-587
EUSA (2)	11-57	11-592
Corps (2)	11-98	11-597
	11-117	32-56

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320-50.

☆U. S. GOVERNMENT PRINTING OFFICE: 1974--557790

SPECTRUM ANALYZERS TS-723A/U TS-723B/U, AND TS-723C/U

TM 11–5097
TO 33A1–5–64–1
CHANGES No. 4

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D.C., *21 August 1961*

TM 11–5097/TO 33A1–5–64–1, 24 January 1957, is changed as follows:

Page 1 of C 2, first item (as changed by C 3, 1 May 1961), change Serial No. "1–550" to 1–1100.

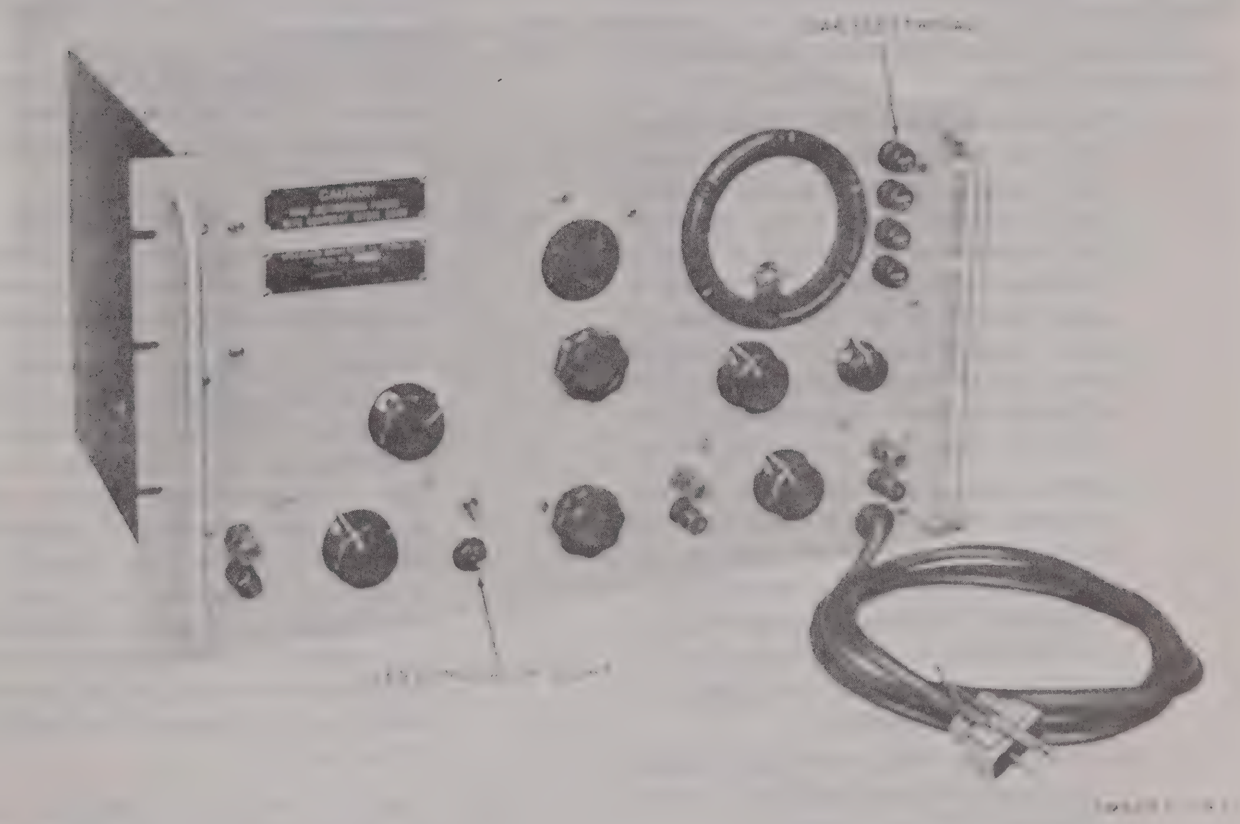

Figure 1.1. (Added) *Spectrum Analyzer TS–723B/U.*

Page 3, paragraph 1*a*, line 3, (page 1 of C 1). After "TS–723B/U" add: (fig. 1.1).

***These changes supersede C 3, 1 May 1961, and so much of TM 11–6625–255–12P, 27 October 1959, including C 1, 25 April 1960, as pertains to maintenance allocation chart and first echelon items.**

Paragraph 2. Add the following after subparagraph *c*(2):

d. Parts List Form. Forward DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9) direct to the Commanding Officer, U.S. Army Signal Materiel Support Agency, ATTN: SIGMS–ML, Fort Monmouth, N. J., with comments on appendixes I and II.

APPENDIX I (Added)
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

1. General

a. The maintenance allocation chart assigns maintenance functions and repair operations to be performed by the lowest appropriate maintenance echelon.

b. Columns in the maintenance allocation chart are as follows:

(1) *Part or component.* This column shows only the nomenclature or standard item name. Additional descriptive data are included only where clarification is necessary to identify the part. Components and parts comprising a major end item are listed alphabetically. Assemblies and subassemblies are in alphabetical sequence with their components listed alphabetically immediately below the assembly listing.

(2) *Maintenance function.* This column indicates the various maintenance functions allocated to the echelon capable of performing the operations.

(*a*) *Service.* To clean, to preserve, and to replenish fuel and lubricants.

(*b*) *Adjust.* To regulate periodically to prevent malfunction.

(*c*) *Inspect.* To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.

(*d*) *Test.* To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.

(*e*) *Repair.* To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes but is not limited to inspecting, cleaning, preserving, adjusting, replacing, welding, riveting, and straightening.

(*f*) *Aline.* To adjust two or more components of an electrical system so that their functions are properly synchronized.

(*g*) *Calibrate.* To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.

(*h*) *Rebuild.* To restore an item to a standard as near as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements using original manufacturing tolerances and/or specifications, and subsequent reassembly of the item.

(3) *1st, 2d, 3d, 4th, and 5th echelon.* The symbol X indicates the echelon responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the echelon marked by X are authorized to perform the indicated operation.

(4) *Tools required.* This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment referenced. The grouping of codes in this column of the maintenance allocation chart indicates the tool, test, and maintenance equipment required to perform the maintenance function.

(5) *Remarks.* Not used.

c. Columns in the allocation of tools for maintenance functions chart are as follows:

(1) *Tools required for maintenance functions.* This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

(2) *1st, 2d, 3d, 4th, and 5th echelon.* The dagger (†) indicates the echelons allocated the facility.

(3) *Tool code.* This column lists the tool code assigned.

(4) *Remarks.* Not used.

2. Mounting Hardware

The basic entries of the maintenance allocation chart do not include mounting hardware such as screws, nuts, bolts, washers, brackets, clamps, etc.

3. Maintenance by Using Organizations

When this equipment is used by signal service organizations organic to theater headquarters or communication zones, those maintenance functions allocated up to and including fourth echelon are authorized to the organization operating this equipment.

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH	(4) 2ND ECH	(5) 3RD ECH	(6) 4TH ECH	(7) 5TH ECH	(8) TOOLS REQUIRED	(9) REMARKS
ANALYZER SPECTRUM TS-723/U; TS-723A/U; TS-723B/U; TS-723C/U								
	repair				X		10	
	rebuild					X	10	
	service				X			
	adjust				X		10	
	inspect				X			
	test				X		2,4,5,8,9,11	
	algin				X		1,3,6,7	
	calibrate				X		1,11	

(1) TOOLS REQUIRED FOR MAINTENANCE FUNCTIONS	(2) 1ST ECH	(3) 2ND ECH	(4) 3RD ECH	(5) 4TH ECH	(6) 5TH ECH	(7) TOOL CODE	(8) REMARKS
TS-723/U; TS-723A/U; TS-723B/U; TS-723C/U (continued)							
AUDIO OSCILLATOR TS-382/U				†	†	1	
ELECTRONIC MULTIMETER TS-505/U				†	†	2	
FREQUENCY METER FR-67/U				†	†	3	
METER TEST SET TS-682/GSM-1				†	†	4	
MULTIMETER AN/URM-105				†	†	5	
OSCILLOSCOPE OS-8A/U				†	†	6	
SIGNAL GENERATOR SG-71/FCC				†	†	7	
TEST SET, ELECTRON TUBE TV-2/U					†	8	
TEST SET, ELECTRON TUBE TV-7/U				†		9	
TOOL EQUIPMENT TE-113				†	†	10	
VOLTMETER, METER ME-30/U				†	†	11	
Tools and Test equipment available to the repairman user because of his assigned mission		†					

APPENDIX II (Added)
BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

1. General

This appendix lists items supplied for initial operation and for running spares. The list includes tools, accessories, parts, and material issued as part of the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning.

2. Columns

a. Source, Maintenance and Recoverability Code. Not used.

b. Federal Stock Number. This column lists the 11-digit Federal stock number.

c. Designation by Model. The dagger (†) indicates the model in which the part is used and further, by its position, designates the reference symbol in which the item is identified, and/or the quantity used in each model where the quantity varies.

d. Description. Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

e. Unit of Issue. Not used.

f. Expendability. Not used.

g. Quantity Authorized. Under "Items Comprising an Operable Equipment," the column lists the quantity of items supplied for the initial operation of the equipment. Under "Running Spares and Accessory Items," the quantities listed are those issued initially with the equipment as spare parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment.

h. Illustrations. The item No. column lists the reference symbols used for identification of the items in the illustration and text of the manual. Tubes, fuses, and lamps are illustrated in figure 25.1.

SECTION II FUNCTIONAL PARTS LIST

(1) Source Maintenance and Recoverability Code	(2) Federal Stock Number	(3) Designation by Model 1	2	3	4	(4) Description	(5) Unit of Issue	(6) Expendability	(7) Quantity Authorized	(8) Illustrations Figure No	(9) Illustrations Item No
	6625-668-9418					ANALYZER SPECTRUM TS-723/U, TS-723A/U, TS-723B/U, TS-723C/U: 20-20,000 cps range 3 band, 4 channel; 115 v-230 v; 50-1000 cyc, 1 ph 14 1/2 in lg x 20 3/4 in w x 12 1/2 h o/a					
						NOTE: Model Column 1 refers to TS-723/U; Column 2 refers to TS-723A/U; Column 3 refers to TS-723B/U; Column 4 refers to TS-723C/U					
						ITEMS COMPRISING AN OPERABLE EQUIPMENT					
						ANALYZER, SPECTRUM TS-723/U; TS-723A/U; TS-723B/U; TS-723C/U: (BASIC COMPONENT)			1		
	Ord thru AGC	+	+	+	+	TECHNICAL MANUAL TM 11-5097			2		
	5920-665-5176	+	+			CAP, ELECTRICAL: Littlefuse part No. 342003-SA-2			2		EF1, EF2
	5960-188-8573	+	+	+	+	ELECTRON TUBE: MIL type OD3			1		V10
	5960-262-0218	+	+	+	+	ELECTRON TUBE: MIL type 5Y3WGTA			1		V7
	5960-166-7666	+	+	+	+	ELECTRON TUBE: MIL type 6AC7			3		V6, V12 V13
	5960-188-8499	+	+	+	+	ELECTRON TUBE: MIL type 6H6			1		V14
	5960-228-3765	+	+	+	+	ELECTRON TUBE: MIL type 6J5WGT			2		V4, V11
	5960-100 5268	+	+			ELECTRON TUBE: MIL type 6SJ7Y			4		V2, V3, V5, V9
	5960-188-3574		+	+		ELECTRON TUBE: MIL type 6SJ7WGT			4		V2, V3, V5, V9
	5960-114-3808	+	+			ELECTRON TUBE: MIL type 6Y6G			1		V8
	5960-114-4915		+	+		ELECTRON TUBE: MIL type 6Y6GT			1		V8
	5920-131 9819	+	+			FUSE, CARTRIDGE: Buss part No. MDL1.6; (used in serial nos 2023 and above)			1		F1
	5920-685-9763		+	+		FUSE, CARTRIDGE: Bussman type No. MDX			1		F1
	5920-043-2641	+				FUSE, CARTRIDGE: Littlefuse part No. 312.250 used in Ser No. 2022 and below			1		F1
	5920 199-3968	+	+			FUSE, CARTRIDGE; Buss part No. MDL.8; (used in serial nos 2023 and above)			1		F1
	5920 513 0006		+			FUSE, CARTRIDGE: Littlefuse part No. 313.150			1		F2
	5920-050 1953	+				FUSE, CARTRIDGE: Littlefuse type No. 31201.5; (used in serial nos 2022 and below)			1		F2
	5920 503 0151		+	+		FUSE, CARTRIDGE: Bussman type No. MDL			1		F2
	6240 155 8706	+	+			LAMP, INCANDESCENT: GE part No. 47 per Sig LM-26			1		I1
				+	+				2		DS1, DS2
	6250 729-9619			+	+	LENS, INDICATOR, LIGHT: Dialco type No. 111			1		XDS1A

(1) SOURCE MAINTENANCE, AND RECOVERABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL 1	2	3	4	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPENDABILITY	(7) QUANTITY AUTHORIZED	(8) ILLUSTRATIONS FIGURE NO	(9) ILLUSTRATIONS ITEM NO
		1	2	3	4	TS-723/U; TS-723A/U; TS-723B/U; TS-723C/U (continued)					
	6625-395-9313	†	†			TEST LEAD SEY CX-1331/U; CX-1331A/U			1		
	5960-270-5405	†				SHIELD, ELECTRON TUBE: H-P part/dwg No. 16M-M-326			1		E17, E31
						RUNNNING SPARES AND ACCESSORY ITEMS					
	5960-188-8573	†	†	†	†	ELECTRON TUBE: MIL type OD3			1		
	5960-262-0218	†	†	†	†	ELECTRON TUBE: MIL type 5Y3WGTA			1		
	5960-166-7666	†	†	†	†	ELECTRON TUBE: MIL type 6AC7			1		
	5960-188-8499	†	†	†	†	ELECTRON TUBE: MIL type 6H6			1		
	5960-228-3765	†	†	†	†	ELECTRON TUBE: MIL type 6J5WGT			1		
	5960-100-5268	†	†			ELECTRON TUBE: MIL type 6SJ7Y			2		
	5960-188-3574			†	†	ELECTRON TUBE: MIL type 6SJ7WGT			2		
	5960-114-3808	†	†			ELECTRON TUBE: MIL type 6Y6G			1		
	5960-114-4915			†	†	ELECTRON TUBE: MIL type 6Y6GT			1		
	5920-131-9819	†	†			FUSE, CARTRIDGE: Buss part No. MDL1.6; (used in serial nos 2023 and above)			5		
	5920-685-9673			†	†	FUSE, CARTRIDGE: Bussman type MDX			5		F1
	5920-043-2641	†				FUSE, CARTRIDGE: Littlefuse part No. 312.250			5		
	5920-199-3968	†	†			FUSE, CARTRIDGE: Buss part No. MDL.8; (used in serial nos 2023 and above)			5		
	5920-543-0006		†			FUSE, CARTRIDGE: Littlefuse part No. 313.150			5		
	5920-050-4953	†				FUSE, CARTRIDGE: Littlefuse type No. 31201.5; (used in serial nos 2022 and below)			5		
	5920-503-0454			†	†	FUSE, CARTRIDGE: Bussman type No. MDL			5		
	6240-155-8706	†	†	†	†	LAMP, INCANDESCENT: GE part No. 47 per Sig LM-52			1		1-1, DS1, DS2

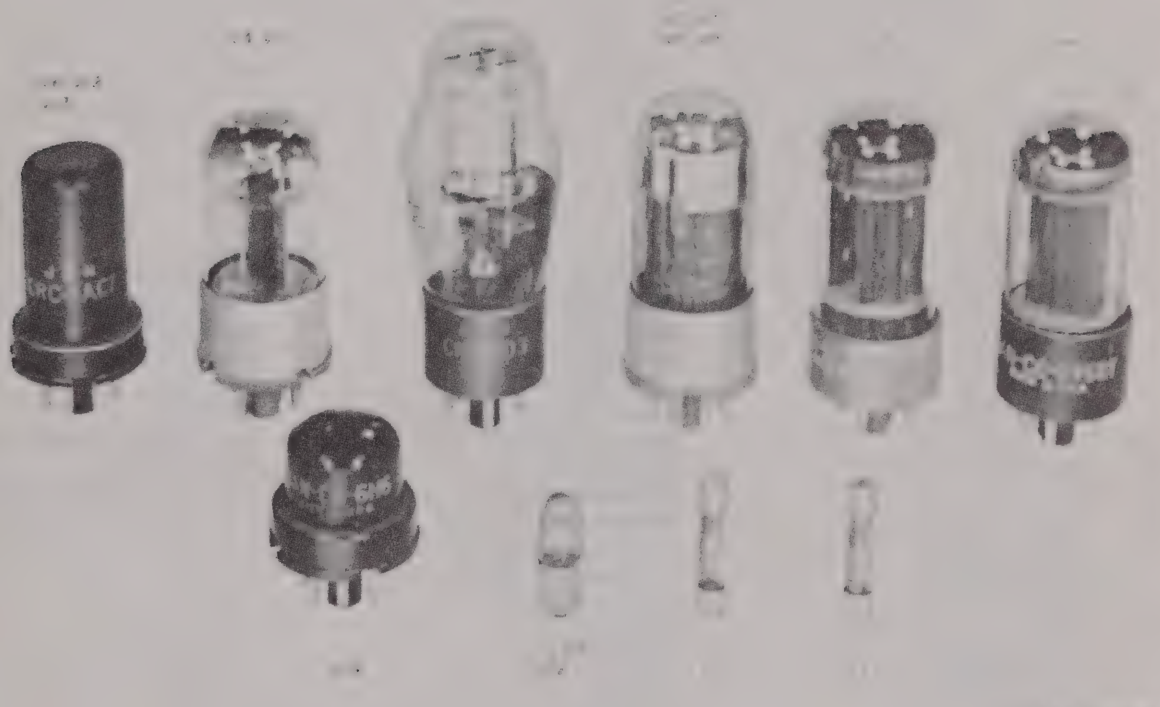

Figure 25.1. (Added) *Running spares and accessory items.*

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:
R. V. LEE,
Major General, United States Army,
The Adjutant General.

CURTIS E. LEMAY
Chief of Staff, United States Air Force.

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Atlanta GENDEP (None)
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Sig Dep (12)
Ft Monmouth (63)
Madigan Gen Hosp (5)
Pine Bluff Cml Arsenal (5)
Anniston Ord Dep (5)
USASATSA (5)
AFIP (1)
WRAMC (1)
AFSSC (1)
USAEPG (2)
EMC (1)
USACA (2)
USASEA (1)
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USA Sig Msl Spt Agcy (12)
USASSA (20)
USASSAMRO (1)
Army Pictorial Cen (2)
USAOMC (3)
USA Trans Tml Comd (1)
Army Tml (1)
POE (1)
OSA (1)
AMS (1)
Sig Fld Maint Shops (2)
JBUSMC (2)
Units org under fol TOE:
(2cy each UNOINDC)
6–630
9–217
11–7
11–16
11–57
11–98
11–117
11–155
11–500 (AA–AE) (4)
11–557
11–587
11–592
11–597
33–56
33–500 (AC)

NG: State AG (3); Units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

☆U. S. GOVERNMENT PRINTING OFFICE: 1974-0-557789

TECHNICAL MANUAL

SPECTRUM ANALYZERS TS–723A/U, TS–723B/U, AND TS–723C/U

TM 11–5097 }
CHANGES No. 5 }

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *25 September 1963*

TM 11–5097, 24 January 1957, is changed as follows:

Note. The parenthetical reference to previous changes (example: "page 1 of C 2") indicates that pertinent material was published in that change.

Page 3, paragraph 1 (page ii of C 4). Delete subparagraph *b.*

Add paragraph 1.1 after paragraph 1:

1.1. Index of Publications

Refer to the latest issue of DA Pam 310–4 to determine whether there are new editions, changes or additional publications pertaining to your equipment. DA Pam 310–4 is an index of current technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders available through publications supply channels. The index lists the individual parts (–10, –20, –35P, etc.) and the latest changes to and revisions of each equipment publication.

Delete paragraph 2 (page ii of C 4) and substitute:

2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38–750.

b. Report of Damaged of Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700–58 (Army), NAVSANDA Publication 378 (Navy), and AFR 71–4 (Air Force).

c. Reporting of Equipment Manual Improvements. The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended changes to DA technical manual parts lists or supply manual 7, 8, or 9) will be used for reporting these improvements. This form will be completed in triplicate using pen, pencil, or typewriter. The original and one copy will be forwarded direct to: Commanding Officer, U. S. Army Electronics Materiel Support Agency, ATTN: SELMS–MP, Fort Monmouth, New Jersey, 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc.).

Page 14. Change chapter heading to: MAINTENANCE INSTRUCTIONS.

Delete sections I and II, and figure 6 and 7, and substitute:

Section I. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

26. Scope of Maintenance

The maintenance duties assigned to the operator and organizational repairman of the equipment are listed below together with a reference to the paragraphs covering the specific maintenance functions.

a. Daily preventive maintenance checks and services (par. 29).

b. Weekly preventive maintenance checks and services (par. 30).

c. Monthly preventive maintenance checks and services (par. 31).

d. Quarterly preventive maintenance checks and services (par. 32).

e. Cleaning (par. 32.1).

f. Touchup painting (par. 32.2).

g. Lubrication (pars. 33 and 34).

h. Troubleshooting (pars. 38 and 39).

27. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 29 through 32.1 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (pars. 29, 30, 31, and 32) outline functions to be performed at specific intervals. These checks and services are to maintain Army electronic equipment in a combat serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and what the normal conditions are. The *References* column lists the illustrations, paragraphs, or manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by performing the corrective actions listed, higher echelon maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38–750.

28. Preventive Maintenance Checks and Services Periods

Preventive maintenance checks and services of the equipment are required daily, weekly, monthly, and quarterly.

a. Paragraph 29 specifies the checks and services that must be accomplished daily (or at least once each week if the equipment is maintained in standby condition).

b. Paragraphs 30, 31, and 32 specify *additional* checks and services that must be performed on a weekly, monthly, and quarterly basis, respectively.

29. Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Completeness	See that the equipment is complete	Appdx II.
2	Exterior surfaces	Clean the exterior surfaces, including the panel and meter glasses. Check all meter glasses and indicator lenses for cracks.	Par. 32.1.
3	Connectors	Check the tightness of all connectors.	
4	Controls and indicators	While making the operating checks (item 5), observe that the mechanical action of each knob, dial, and switch is smooth and free of external or internal binding, and that there is no excessive looseness. Check the meter for sticking or bent pointer and the tuning dial indicator for a glow.	
5	Operation	Operate the equipment according to paragraph 39.	

30. Weekly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Cable	Inspect cable for chafed, cracked, or frayed insulation. Replace connectors that are broken, arced, or worn excessively.	
2	Metal surfaces	Inspect exposed metal surfaces for rust and corrosion. Touchup paint as required.	Par. 32.2.

31. Monthly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Lubrication	Lubricate the equipment	Pars. 33 and 34 and fig. 8.
2	Pluckout items	Inspect seating pluckout items. Make sure that tube clamps grip tube bases tightly.	
3	Jacks	Inspect jacks for snug fit and good contact.	
4	Transformer terminals	Inspect the terminals on the power transformer. All nuts must be tight. There should be no evidence of dirt or corrosion.	
5	Terminal blocks	Inspect terminal blocks for loose connections and cracked or broken insulation.	
6	Resistors and capacitors	Inspect the resistors and capacitors for cracks, blistering, or other detrimental defects.	
7	Variable capacitors	Inspect variable capacitors for dirt, corrosion, and deformed plates.	
8	Interior	Clean interior of chassis and cabinet.	

32. Quarterly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Publications	See that all publications are complete, serviceable, and current.	DA Pam 310–4.
2	Modifications	Check DA Pam 310–4 to determine if new applicable MWO's have been published. All urgent MWO's must be applied immediately. All NORMAL MWO's must be scheduled.	TM 38–750 and DA Pam 310–4.
3	Spare parts	Check all spare parts (operator and organizational) for general condition and method of storage. There should be no evidence of overstock, and all shortages must be on valid requisitions.	Appx III and TM 11–6625–255–20P.

32.1. Cleaning

Inspect the exterior of the spectrum analyzer. The exterior surfaces should be clean, and free of dust, dirt, grease, and fungus.

a. Remove dust and loose dirt with a cleaning soft cloth.

Warning: **Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation.** ***Do not*** **use near a flame.**

b. Remove grease, fungus, and ground-in dirt from the cases; use a cloth dampened (not wet) with cleaning compound (Federal stock No. 7930–395–9542).

c. Remove dust or dirt from plugs and jacks with a brush.

Caution: **Do not press on the meter face (glass) when cleaning; the meter may become damaged.**

d. Clean the front panel, meters, and control knobs; use a soft clean cloth. If dirt is difficult to remove, dampen the cloth with water; mild soap may be used.

32.2. Touchup Painting Instructions

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TM 9–213.

Page 56. Add appendix I after chapter 7:

APPENDIX I

REFERENCES

Following is a list of applicable publications available to the personnel maintaining Spectrum Analyzers TS–723A/U, TS–723B/U, and TS–723C/U.

DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TM 9–213	Painting Instructions for Field Use.
TM 11–1214	Instruction Book for Oscilloscope OS–8A/U.
TM 11–2535A	Meter Test Equipments AN/GSM–1B and AN/GSM–1C.
TM 11–2684	Audio Oscillators TS–312/FSM–1, TS–312A/FSM–1, and TS–382/U and Signal Generator TS–312B/FSM–1.
TM 11–2698	Frequency Meter FR–67/U.
TM 11–5088	Generators, Signal SG–71/FCC, SG–71A/FCC, and SG–71B/FCC.
TM 11–5511	Electronic Multimeter TS–505/U.
TM 11–6625–203–12	Operator and Organizational Maintenance: Multimeter AN/URM–105, including Multimeter ME–77/U.
TM 11–6625–255–20P	Organizational Maintenance Repair Parts and Special Tools List: Analyzer Spectrums TS–723/U, TS–723A/U, TS–723B/U, and TS–723C/U.
TM 11–6625–255–35P	Field and Depot Maintenance Repair Parts and Special Tools Lists: Analyzers, Spectrum TS–723/U, TS–723A/U, TS–723B/U, and TS–723C/U.
TM 11–6625–274–12	Operator's and Organizational Maintenance Manual: Test Sets, Electron Tube TV–7/U, TV–7A/U, TV–7B/U, and TV–7D/U.
TM 11–6625–316–12	Operator and Organizational Maintenance Manual Test Sets Electron Tube TV–2/U, TV–2A/U, and TV–2B/U.
TM 11–6625–320–12	Operator's and Organizational Maintenance Manual: Voltmeter, Meter ME–30A/U and Voltmeters, Electronic ME–30B/U and ME–30C/U.
TM 38–750	The Army Equipment Record System and Procedures.
(page ii of C4)	Redesignate APPENDIX I as: APPENDIX II.
(page Vi of C4)	Redesignate APPENDIX II as: APPENDIX III.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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Active Army:

DASA (6)
USASA (2)
CNGB (1)
CofEngrs (1)
TSG (1)
CSigO (7)
CofT (1)
OCofSptS (1)
USA CD Agcy (1)
USCONARC (5)
USAMC (2)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (3)
OS Base Comd (2)
LOGCOMD (2)
USAECOM (5)
USAMICOM (4)
USASCC (4)
MDW (1)
Armies (2)
Corps (2)
USA Corps (3)
USATC AD (2)
USATC Engr (2)
USATC Inf (2)
USATC Armor (2)
USASTC (5)
Instl (2) except
  Ft Monmouth (65)
Svc Colleges (2)
Br Svc Sch (2)
GENDEP (OS) (2)
Sig Sec, GENDEP (5)
Sig Dep (OS) (12)
Army Dep (2) except
  Ft Worth (8)
  Lexington (12)
  Sacramento (28)
  Tobyhanna (12)
USA Trans Tml Comd (1)
Army Tml (1)
POE (1)
USAOSA (1)
AMS (1)
WRAMC (1)
AFIP (1)
Army Pic Cen (2)
USA Elct RD Actv,
  White Sands (13)
USA Elct RD Actv,
  Ft Huachuca (2)
USA Mbl Spt Cen (1)
USA Elct Mat Agcy (12)
Chicago Proc Dist (1)
USARCARIB Sig Agcy (1)
Sig Fld Maint Shops (3)
USAAESWBD (5)
Pine Bluff Arsenal (5)
USASATSA (5)
USARADBD (5)
USAPRDC (5)
MGH (5)
Units org under fol TOE:
  9–217 (2)
  11–7 (2)
  11–16 (2)
  11–56 (2)
  11–57 (2)
  11–97 (2)
  11–98 (2)
  11–117 (2)
  11–155 (2)
  11–157 (2)
  11–500 (AA–AE) (4)
  11–557 (2)
  11–587 (2)
  11–592 (2)
  11–597 (2)
  33–56 (2)
  33–500 (AA–AC) (2)

NG: State AG (3).
USAR: None.
For explanation of abbreviations used, see AR 320–50.

U. S. GOVERNMENT PRINTING OFFICE: 1963—700–540/6157A

829–828

SPECTRUM ANALYZERS TS-723A/U, TS-723B/U, TS-723C/U, AND TS-723D/U

CHANGE No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *14 July 1964*

TM 11-5097, 24 January 1957, is changed as indicated so that the manual also applies to the following equipment:

Nomenclature	*Order No.*	*Serial No.*
Spectrum Analyzer TS-723D/U	5257-PP-64-A3-A3	1-255

Change the title of the manual as indicated above.

Note. The parenthetical reference to a previous change (example: page 1 of C 2) indicates that pertinent material was published in that change.

Page 3, chapter 1, note (page 1 of C 2). Add the following to the note:

3. Spectrum Analyzer TS-723D/U is similar to Spectrum Analyzer TS-723C/U. Information in this manual applies to both sets unless otherwise specified.

Paragraph 2*c* (page 1 of C 5). Delete the fourth sentence and substitute: The original and one copy will be forwarded direct to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL-MR-MP, Fort Monmouth, N.J. 07703.

Page 4, paragraph 7.2 (page 1 of C 2). Add paragraph 7.3 after paragraph 7.2.

7.3. Differences Between TS-723C/U and TS-723D/U

The TS-723D/U differs from the TS-723C/U as follows:

a. The meter rectifier circuit uses two diodes (type IN251) and a 1,000-ohm ±10 percent resistor in place of electron tube 6H6 (V14) and resistors R72, R73, and R74.

b. The tube socket, chassis hole for the tube socket, and clamping hardware are not included in the TS-723D/U.

c. The marking of terminal board TB3 has been changed to conform with the component changes.

d. The associated wiring has been changed to conform with the circuit changes.

Page 7, paragraph 13.1 (page 1 of C 2). Change the paragraph heading to Power Transformer (TS-723C/U and TS-723D/U).

Page 8, paragraph 16, chart, last item (page 1 of C 2). Delete (TS-723C/U only) and substitute (TS-723C/U and TS-723D/U only).

Figure 4.2, caption (page 2 of C 2). Change *TS-723C/U* to *TS-723C/U and TS-723D/U.*

Page 20, paragraph 39, chart. Item No. 3.1 (page 2 of C 2). Change (TS-723C/U only) to (TS-723C/U and TS-723D/U only).

Page 33, paragraph 48*i*, line 8 (page 2 of C 2). Change "TS–723C/U" to TS–723C/U and TS–723D/U.

Figure 18.1, caption (page 2 of C 2). Change *TS–723C/U* to *TS–723C/U and TS–723D/U.*

Page 41, paragraph 54, chart, *Probable trouble* column, after line 5 (page 3 of C 2). Change (TS–723C/U) to (TS–723C/U and TS–723D/U).

Page 58, figure 28.1 (fold-out), note 7 (page 3 of C 2). Make the following changes:

Change "TS–723C/U" to TS–723C/U AND TS–723D/U.

Add the following after note 7:

8. THE METER RECTIFIER CIRCUIT HAS BEEN CHANGED IN THE TS–723D/U (FIG. 28.2).

After METER RECTIFIER add: (NOTE 8). Add figure 28.2 after figure 28.1.

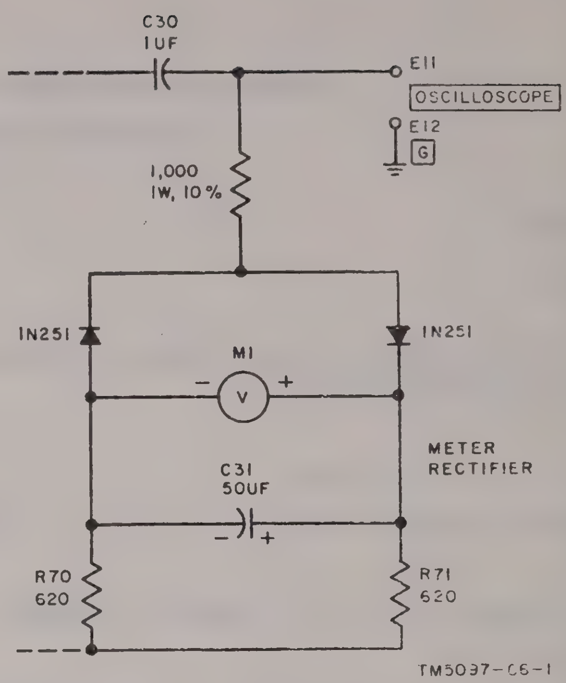

Figure 28.2 Changed METER RECTIFIER circuit, used in TS–723D/U only.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

CNGB (1)
CofT (1)
CofEngrs (1)
TSG (1)
CofSptS (1)
C/COMMEL (7)
USAMC (5)
USCONARC (5)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (2) except
  USARYIS (3)
OS Base Comd (2)
LOGCOMD (2)
USAECOM (16)
USAMICOM (4)
USASMCOM (2)
USASCC (4)
USA Engr CD Agcy (1)
USACBRCDA (1)
USACECDA (2)
USAMSCDA (1)
USAOCDA (2)
USAQMCDA (1)
USATCDA (1)
USAADCDA (1)
USAARMCDA (2)
USAAVNCDA (2)
USAARTYCDA (1)
USASWCDA (2)
USASA (2)
1st Fld Sta, USASA (5)
USARSOUTHCOM Sig Agcy (1)
USAARMBD (2)
USAARTYBD (2)
USARADBD (2)
USAAESWBD (2)
MDW (1)
Armies (2)
Corps (2)
USA Corps (3)
GENDEP (2)
Army Dep (2) except
  Lexington, Tobyhanna (12)
  Sacramento (28) Ft Worth (8)
  Letterkenny, Navajo, Savanna (5)
  Sharpe, Charleston (3)
Arsenals: Pine Bluff (5)
Madigan Gen Hosp (5)
MAAG, Iran (5)
USACA, Tiawan (5)
Sig Sec, GENDEP (5)
Sig Dep (12)
11th Air Assault Div (3)
USAERDL (2)
USA Cold Rgn R&E Lab (2)
Svc Colleges (2)
Br Svc Sch (2) except
  USASCS (40) USASESCS (40)
  USAOGMS (60) USALS (5)
USA Tml (1)
POE (1)
Sig Fld Maint Shops (3)
Instl (2) except Ft Monmouth (63)
  WSMR (5) Ft Hancock (4) Ft Gordon (5)
  Ft Huachuca (25) WSMR (5)
USATTCARC (1)
USATTCA (1)
USATTCG (1)
USATTCP (1)
USATC AD (2)
USATC Armor (2)
USATC Engr (2)
USATC Inf (3)
USASTC (3)
WRAMC (1)
USA Pictorial Cen (2)
Chicago Proc Dist (1)
AMS (1)
AFIP (1)
USA Library, TAGO (2)
USA Elct R&D Agcy (WSMR) (13)
USASATSA (5)
Units org under fol TOE: (2 each UNOINDC)
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  1–17
  1–37
  1–67
  7
  9–217

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11–165
11–167
11–237
11–500 AA–AE (4)
11–557
11–587
11–592
11–597
17
17–51
30–25
30–26
33–500 AA–AC
39–51

NG: State AG (3)

USAR: None

For explanation of abbreviations used, see AR 320–50.

U. S. GOVERNMENT PRINTING OFFICE: 1964
801–861

TM 11-5097—SPECTRUM ANALYZER TS-723A/U—1957